July 2, 1956 50 Cents

AVIATION WEEK

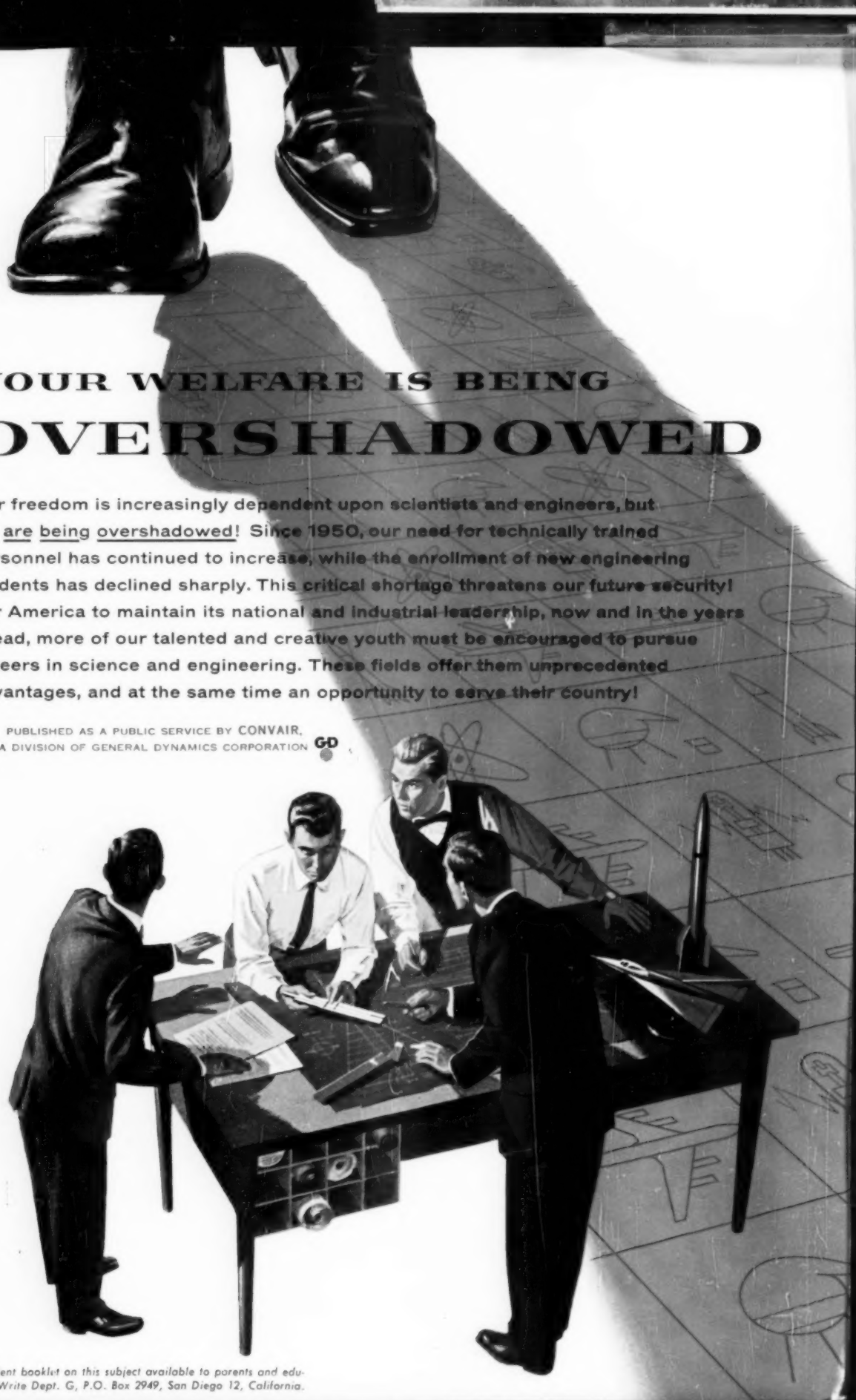
A McGRAW-HILL PUBLICATION

Test Facilities for Mach 5-40 Flight

•

Ag-2 Farm Plane Ready for Testing

T2V-1 SeaStar



YOUR WELFARE IS BEING
OVERSHADOWED

Our freedom is increasingly dependent upon scientists and engineers, but we are being overshadowed! Since 1950, our need for technically trained personnel has continued to increase, while the enrollment of new engineering students has declined sharply. This critical shortage threatens our future security! For America to maintain its national and industrial leadership, now and in the years ahead, more of our talented and creative youth must be encouraged to pursue careers in science and engineering. These fields offer them unprecedented advantages, and at the same time an opportunity to serve their country!

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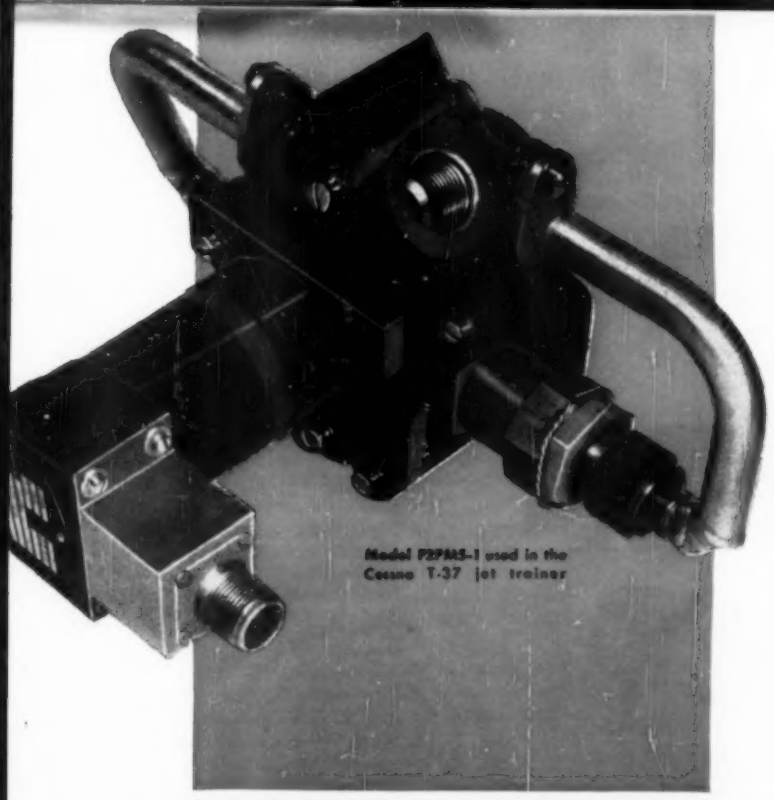
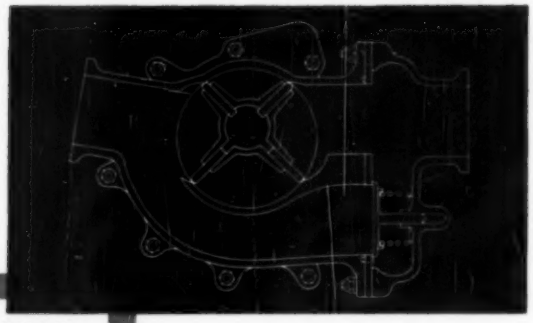
Copies of an excellent booklet on this subject available to parents and educators on request. Write Dept. G, P.O. Box 2949, San Diego 12, California.



Model P2PMS-1 used in the Cessna T-37 jet trainer

MECHANICAL FUEL PROPORTIONERS PRODUCED BY STRATOS



Stratos Fuel Flow Proportioners* offer aircraft fuel systems designers a simple, mechanical method of fuel flow proportioning. Essentially multi-sectioned positive displacement metering devices, the Stratos Fuel Proportioners can be produced in any desired ratios. The units can be motored by the fuel flow, or driven—using electric or hydraulic motor or an air turbine.

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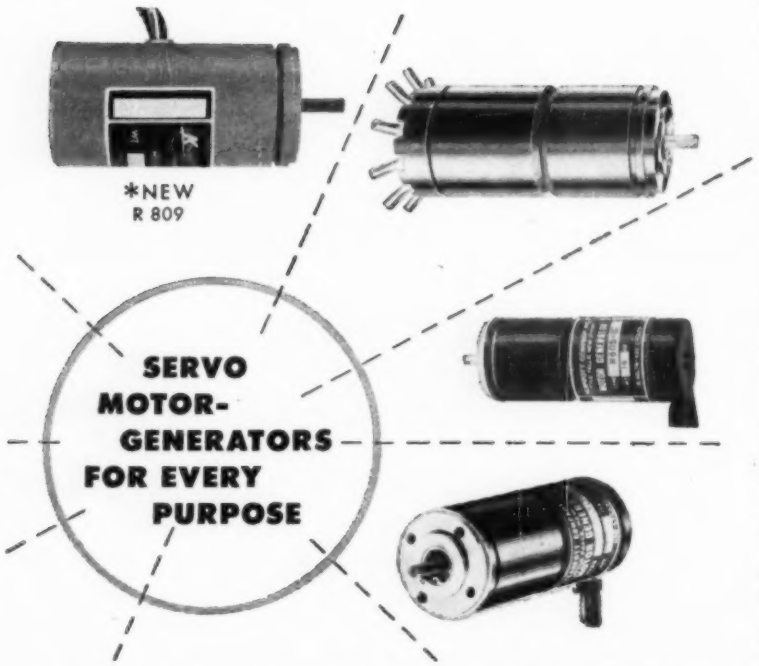
**Developed by Stratos to meet American aeronautical requirements and manufactured under license in the U. S. to basic patents held by Rotol, Ltd.*



Kearfott Servo Motor-Generators are characterized by low rotor inertia, low time constants and high stall torque. Motor-Generator combinations provide ½ to 3.1 volts per 1000 R.P.M. with an extremely linear output over a speed range of 0—3600 R.P.M. and useful output up to 10,000 R.P.M.

**New Size 11 low cost, Servo Motor-Damping Generator Type R 809.*

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TYPE	MOTOR		GENERATOR	
	STALL TORQUE	NO LOAD SPEED	OUTPUT FUND. NULL	LINEARITY
DAMPING				
SIZE 10	.35 OZ. IN.	6000	21/1	.5%
SIZE 10	.30 OZ. IN.	8500	23/1	.5%
NEW R 809	.63 OZ. IN.	5900	25/1	.5%
SIZE 15	1.5 OZ. IN.	5000	25/1	.5%
SIZE 18	2.4 OZ. IN.	5000	25/1	.5%
SIZE 18	3.0 OZ. IN.	9600	23/1	.5%
RATE				
SIZE 15	.45 OZ. IN.	10,500	170/1	.5%
SIZE 15	1.5 OZ. IN.	4700	350/1	.2%
SIZE 18	2.4 OZ. IN.	4700	350/1	.2%
SIZE 18	3.0 OZ. IN.	8400	350/1	.2%
***INTEGRATOR**				
SIZE 15	.70 OZ. IN.	6300	400/1	.1%
SIZE 15	1.25 OZ. IN.	4500	400/1	.1%
SIZE 18	1.35 OZ. IN.	7200	400/1	.1%
SIZE 18	2.4 OZ. IN.	5200	333/1	.06%
SIZE 18	3.0 OZ. IN.	8000	333/1	.06%

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AVIATION CALENDAR

July 7-10—Tenth annual All-Woman Transcontinental Air Race (Powder Puff Derby), San Mateo County Airport, Calif. to Flint, Mich. Entries close June 20. For details write: Mrs. Betty M. Loufek, Loufek & London, 2611 E. Spring St., Long Beach 6, Calif.

July 8—Third annual Western New York Air Show and Races, Niagara Falls Municipal Airport, Niagara Falls, N. Y.

July 15-30—World Parachuting Championship, Moscow, Russia.

July 17-19—Air Transport Association Agency Committee Meeting, Sheraton-Park Hotel, Washington, D. C.

July 31-Aug. 9—23rd Annual U. S. National Soaring Competitions. **Aug. 5**—Air Show, Grand Prairie Airport, Grand Prairie, Texas.

Aug. 1-5—Air Force Association's 1956 National Convention and Airpower Panorama, Roosevelt Hotel, New Orleans, La.

Aug. 6-8—Society of Automotive Engineers National West Coast Meeting, Mark Hopkins Hotel, San Francisco, Calif.

Aug. 7-9—Air Transport Association Standard Practices Committee Meeting, Palace Hotel, San Francisco, Calif.

Aug. 15-17—Institute of the Aeronautical Sciences, National Turbine-Powered Air Transportation Meeting, Grant Hotel, San Diego, Calif.

Aug. 21-24—Western Electronic Show & Convention, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.

Aug. 22-24—Bendix Aviation Corp.'s 1956 International Ignition Conference, Sidney, New York.

Aug. 27-29—Association for Computing Machinery, University of California Westwood Campus, Los Angeles.

Sept. 9-11—International Northwest Aviation Council, 20th annual convention, Boise, Idaho.

Sept. 10-14—American Society of Mechanical Engineers, Instruments & Regulators Div. Meeting, Detroit, Mich.

Sept. 16-22—American Society for Testing Materials, second Pacific National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles, Calif.

AVIATION • JULY 2, 1956

Vol. 65, No. 1

Published weekly with an additional issue in December by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph T. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single Copies 50c. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Second class mail privileges authorized at Albany 1, N. Y. Printed in U. S. A.

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Phillips 66
PRESENTS

MILESTONES IN AVIATION

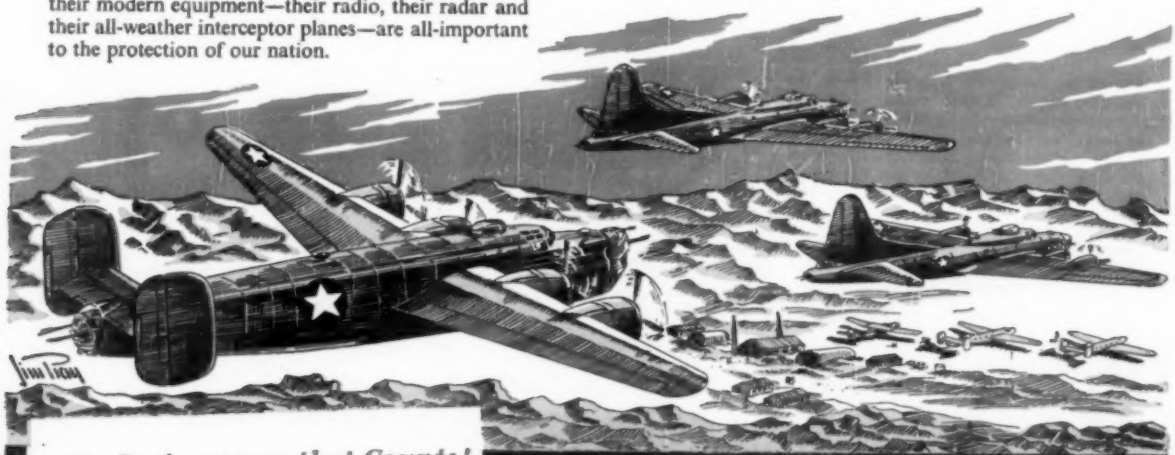
Arctic Outpost

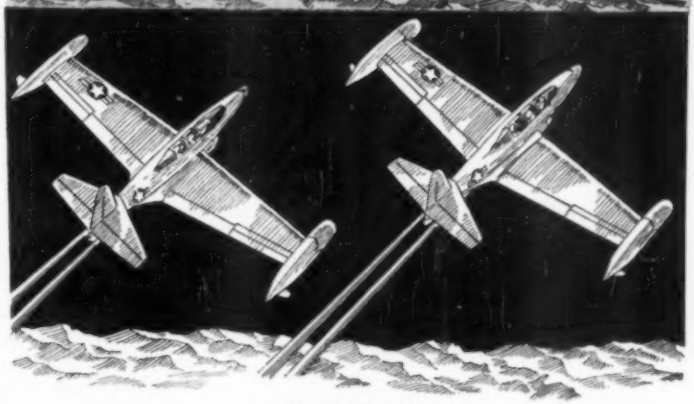
In 1941, the U. S. Army and Air Force decided to establish weather and radio stations, and airfields, on Greenland—to protect the exposed northeast section of the American continent. Lying directly on the air route to the British Isles and Western Europe, the huge ice-capped island of Greenland was an ideally strategic location for repair and refueling stations.

After Pearl Harbor, when clouds of American warplanes began to streak across the icecap, Army and Air Force foresight began to pay off. Airfields, repair and refueling stations, weather and radio stations were all in readiness for the vast air traffic which was to play such a vital part in winning the war.

Today these World War II Arctic Outposts, with their modern equipment—their radio, their radar and their all-weather interceptor planes—are all-important to the protection of our nation.

In 1926, Admiral Byrd (then Lieutenant Commander) and Roald Amundsen were rivals in the race to be first to fly over the North Pole. Byrd made his flight on May 9, 1926, in the tri-motor Fokker *Josephine Ford*. Amundsen followed two days later in the semi-rigid airship *Norge*.





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Phillips produces tremendous quantities of 115/145 grade aviation gasoline for military and commercial use. And today Phillips also is making improved fuels for the latest designs in turbo-props and jets.

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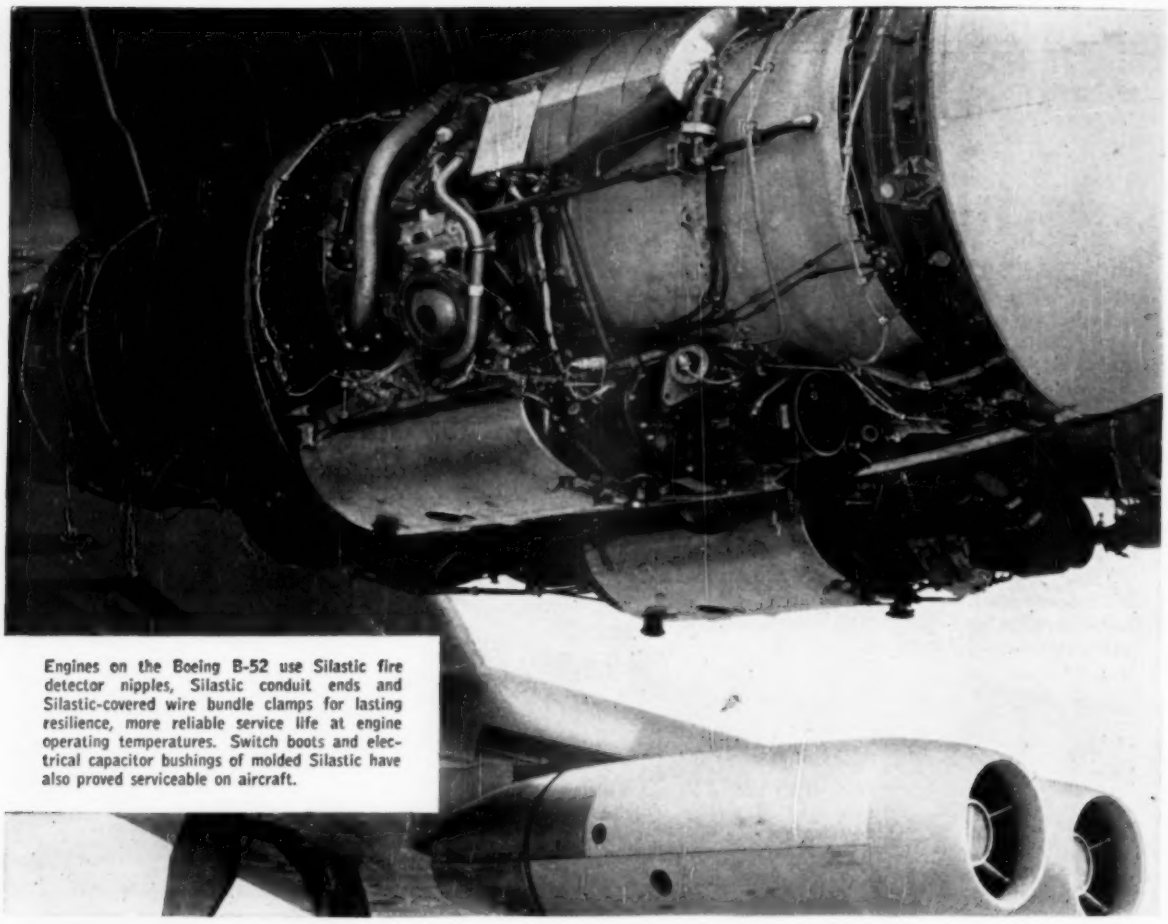
AVIATION PRODUCTS



Engines on the Boeing B-52 use Silastic fire detector nipples, Silastic conduit ends and Silastic-covered wire bundle clamps for lasting resilience, more reliable service life at engine operating temperatures. Switch boots and electrical capacitor bushings of molded Silastic have also proved serviceable on aircraft.

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• Compression set, %, @ 300 F	15 to 40
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• Dielectric strength, volts/mil	400 to 500
• Oil resistance	Dependent on type of oil

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How Holley's Compressor Governors Help New Jets to Supersonic Speeds

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Sharing in the development of this new brood of supersonic fighters, Holley engineers, working closely with Pratt & Whitney Aircraft on the J-57 engine, designed the compressor bleed governor.

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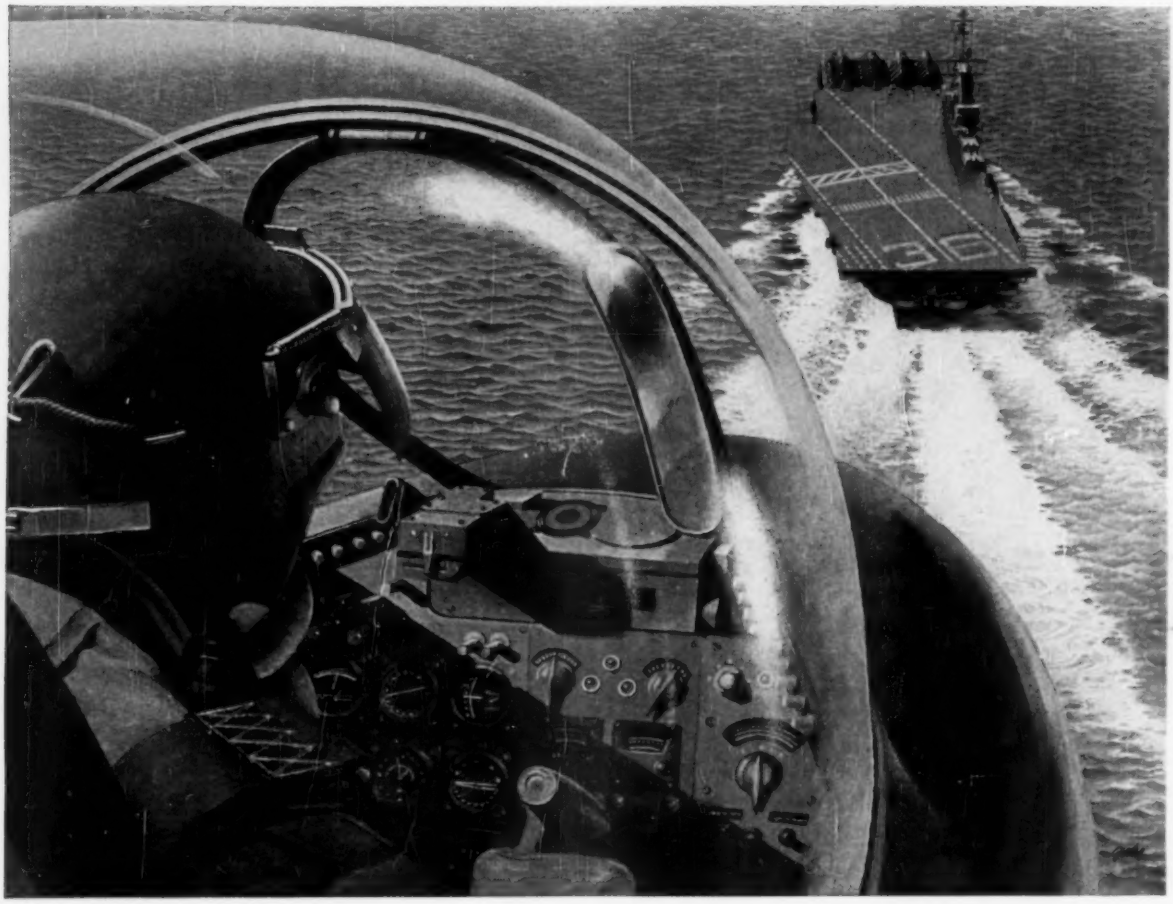

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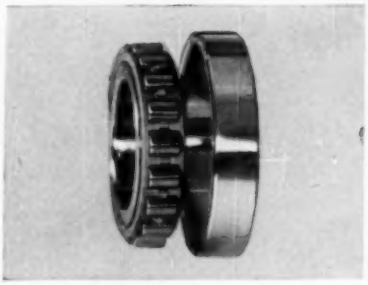

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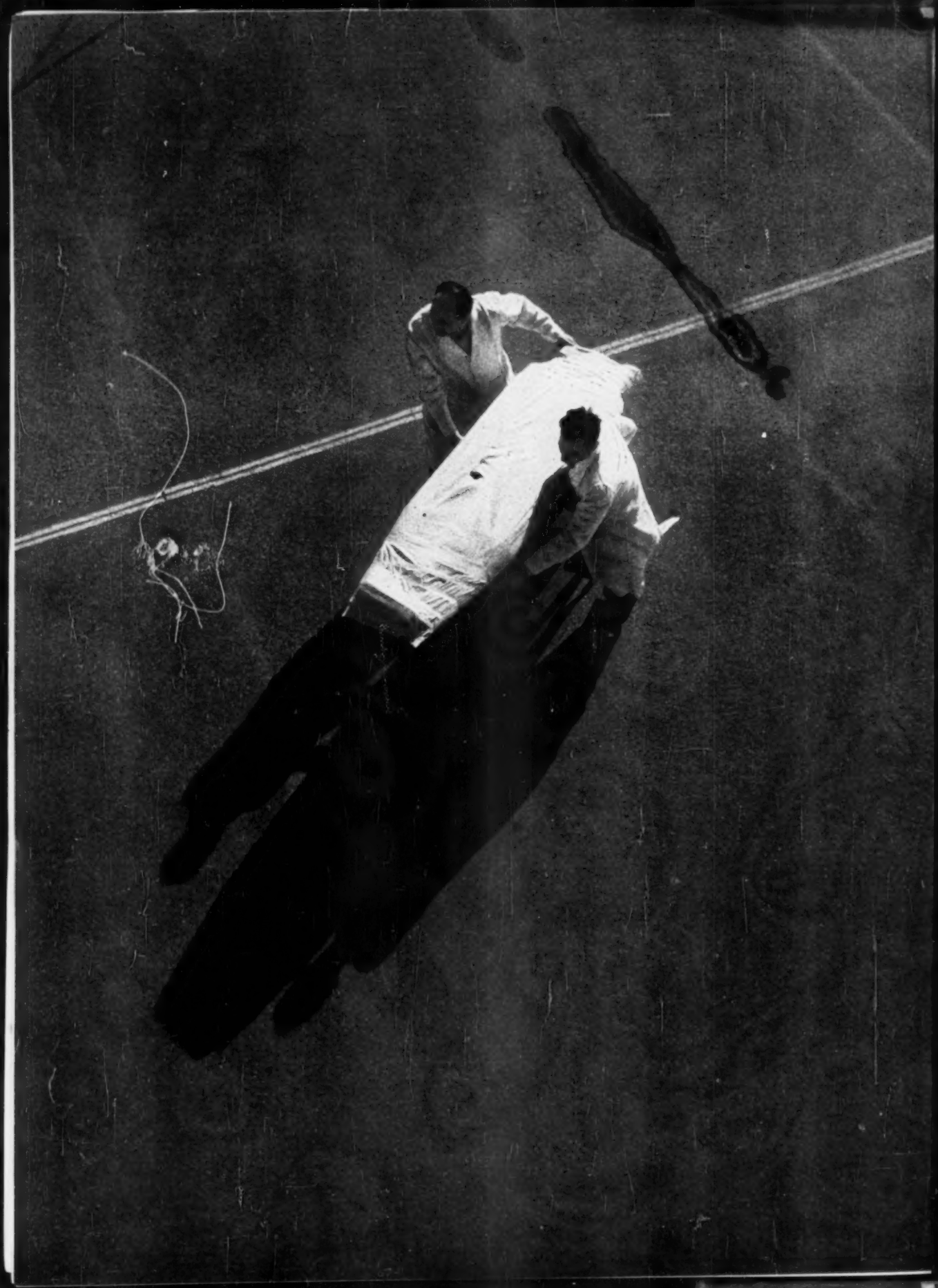

THIS MUMMY DOES A STRIP-TEASE AFTER DARK

One of the most important phases of missile research is the electronic transmission of data from a missile in flight—about its speed and position, aerodynamic behavior, reaction to extremes of heat and cold, and a mass of other highly technical information—to scientists and technicians on the ground. An interesting example of Lockheed's leadership in advanced telemetering techniques is this "mummy"—an antenna, shrouded to conceal its secret configuration, and kept in a guarded vault during the daylight hours. Only after dark is it mounted atop a pylon, then unwrapped for tests made to determine the antenna's radiation pattern characteristics. Initial result: improved communications between a missile in flight and telemetering ground stations. Ultimate result: improved missiles to bolster our nation's defenses against attack.

Long ago our Pentagon planners initiated an accelerated program to achieve unchallenged U.S. technological superiority in aerial weapons. Lockheed's role in this race for supremacy is an important one. Today, more than 3,000 top-flight scientists, engineers and technicians are engaged in high-priority projects at Lockheed Missile Systems Division, Van Nuys, California. At Palo Alto, California, two new research laboratories are nearing completion in Stanford University's Industrial Park area. And on a nearby 275-acre site, at Sunnyvale, Lockheed Missile Systems Division is building extensive new engineering and manufacturing facilities—for the development and production of aerial weapons to help America maintain the peace of the world.

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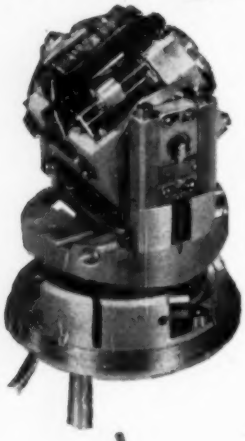

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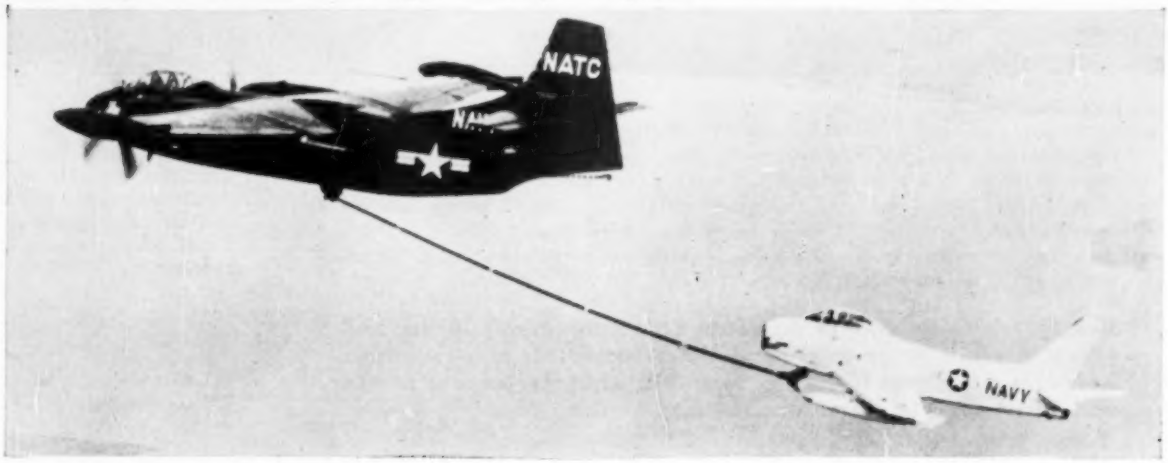

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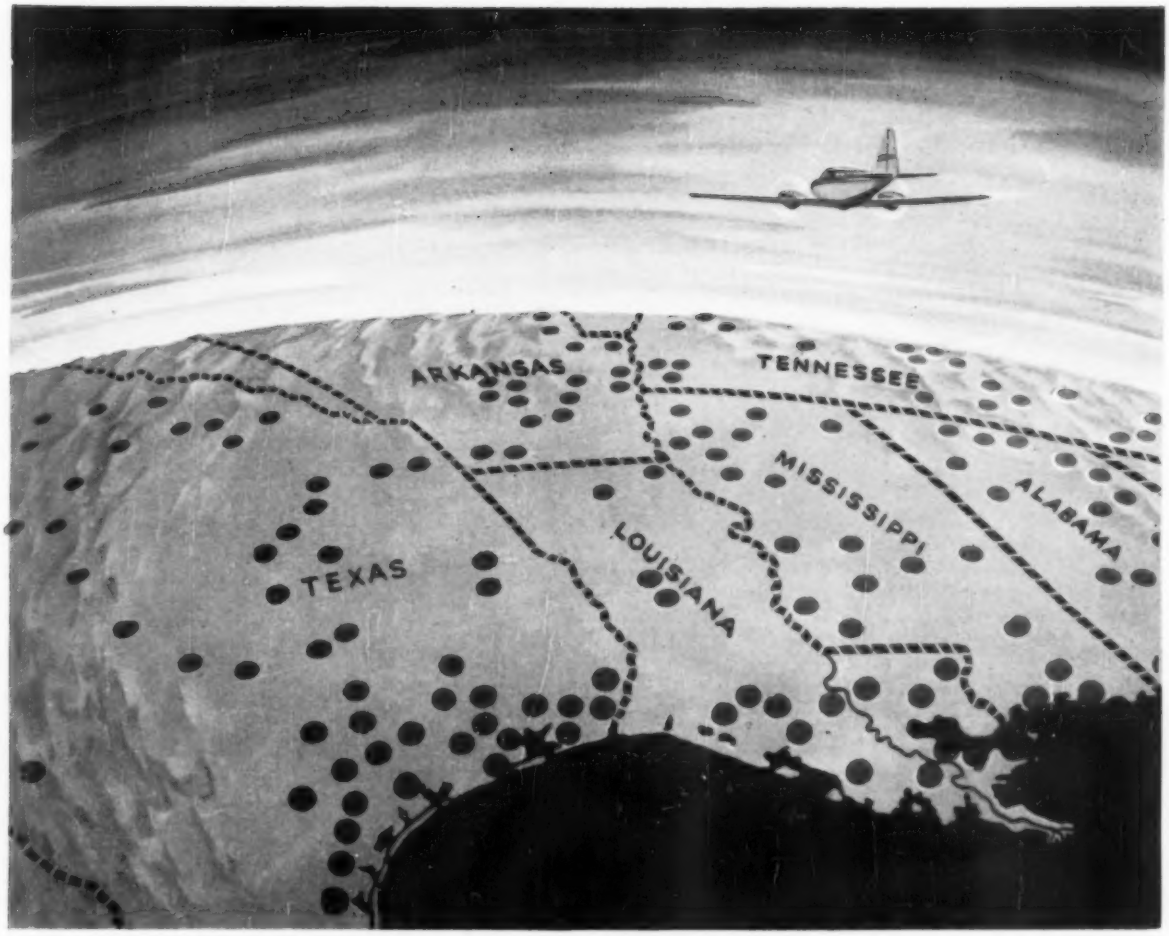

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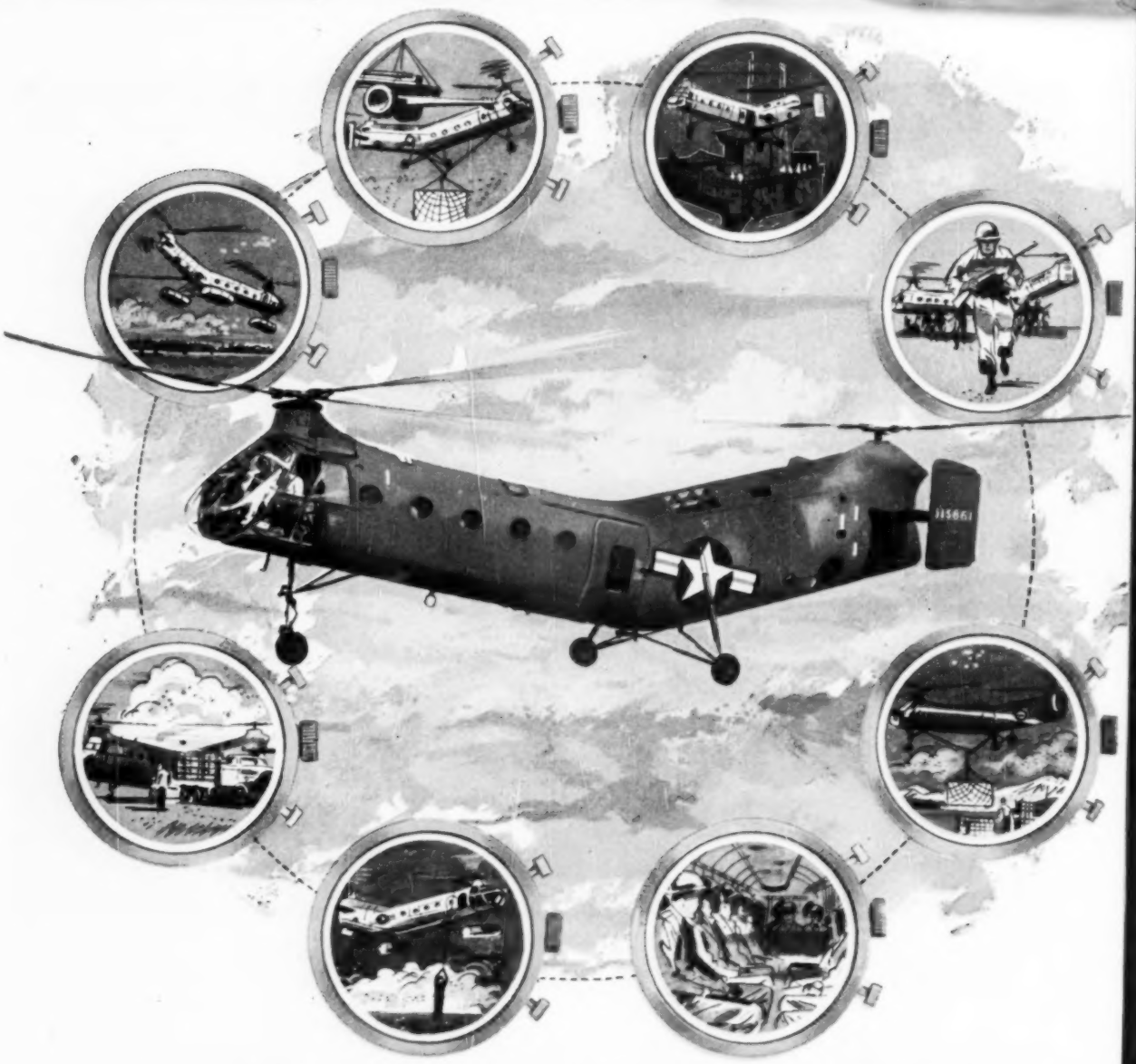

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JULY 2, 1956

AVIATION WEEK

VOL. 65, NO. 1

New York 36—330 W. 42nd St., Phone: LOngacre 4-3000 (Night LO 4-3035)

Editorial Offices Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630

Los Angeles 17—1125 West Sixth St., Phone: MAdison 6-9351

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COVER: Lockheed T2V-1 SeaStar, an evolution of the T-33 design, duplicates the planform of predecessor. Trainer for Navy carrier use has boundary layer control and leading edge slats for increased low speed stability. Redesigned empennage provides greater stability over entire speed range. Landing speed as a result is cut 4 kts., takeoff speed 7 kts. and pattern speeds 15%. Powerplant is Allison J33-A24 centrifugal flow turbojet rated at 6,100 lb. dry.

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AVIATION WEEK • JULY 2, 1956 • Vol. 65, No. 1
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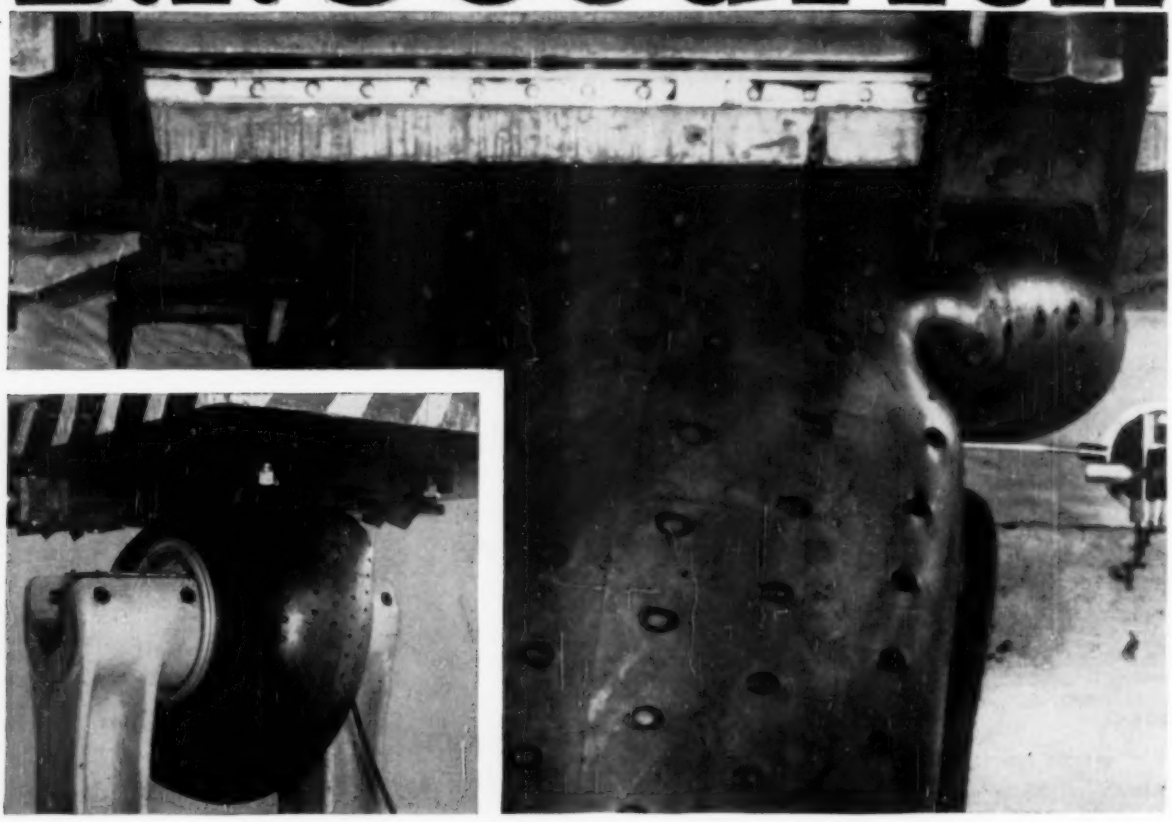

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EDITORIAL

Avionics Reliability vs. USAF Capability

(The Air Force this month will accept delivery of a new piece of avionic equipment, the first of its type to become ready for operational use. Its development was begun in 1945. Coupled with the need for better reliability, this slow development cycle of avionic gear poses a problem of the first magnitude and presents a threat to our airpower capability. This problem was discussed by Maj. Gen. Thomas P. Gerrity, USAF assistant for production programing, in a recent address before the Electronics Association. Aviation Week is presenting significant extracts because of its interest to the entire aviation industry.)

. . . Tremendous advances have been made during the past decade in weapon systems utilized by the Air Force for the performance of our mission, and of particular interest . . . is the increased use of electronic equipment in our weapons. This use, which has unquestionably increased our capability in an era of supersonic speeds, has grown steadily over the past few years. . . .

Reliability Failures

Inherent in any growth of this nature are many problems which the industry and Air Force must solve if we are to increase our utilization of the electronic equipment. The major problems presently being encountered are: Lack of adequate specifications caused by late development, failure to meet production schedules and, most important of all, failure to achieve satisfactory reliability.

. . . Development time tables have not always been met. For example, of the total amount programed for Fiscal 1955, only 72% was obligated as of 31 March, 1956, nine months after the end of the fiscal year, principally because of delays in development. The impact of these engineering and development difficulties is also reflected in our production record for calendar year 1955 during which deliveries of major electronics' equipment were only 80% of the dollar value of scheduled production.

These delays have disrupted our progress in achieving a balanced capability in our air and ground environment. In addition, as a result of these delays, we have not been able to carry out planned procurement programs. Therefore, our current programs are being discounted until we have demonstrated a capability of meeting desired production goals.

Another problem is reliability. During my tenure of duty as a tactical commander from 1950 to 1953, the vast majority of mission aborts were caused by failure of the electronic gear incorporated in the various systems such as bombing-navigation, fire control and communications.

. . . The evolution of the jet engine has given us greater speeds, more reliability and reduced the maintenance workload over that previously required for the reciprocating engine. Conversely, electronic equipments have increased the maintenance workload tremendously by virtue of our failure to achieve the necessary reliability.

This problem is further aggravated by the large turnover of military personnel who maintain our electronic equipment. It is currently estimated that 42% of our skilled electronic personnel will leave military service during the next two years, for the Air Force has not been able to compete with the salaries and benefits offered by industry. . . .

The weapon system concept and other Air Force policies emphasize the added responsibility that we are placing in the hands of industry. One example that I might cite is our spare-parts provisioning.

The Air Force includes, in its basic contract, information relative to the planned utilization, such as programed flying or operating hours, mobilization prepositioning or "kit" requirements. The contractor is given the responsibility to select the spares and release them for production without prior approval of the Air Force. The costs of cancellation resulting from subsequent nonapproval by the Air Force of the contractor's actions by the provisioning team are borne by the government. Our experience to date shows that the costs of cancellation have been insignificant, whereas this authority has contributed appreciably to the attainment of adequate and concurrent support.

Industry Challenges

I think this procedure demonstrates our feeling that industry has, or must be expected to develop, a capability to analyze properly the proposed utilization of a piece of equipment and recommend the range of spares required.

As I see it, the electronic industry faces some very important challenges today. These are:

- **Much greater gains** must be made in simplicity and reliability of electronics systems.
- **We must achieve** a closer adherence to our development-production schedules.
- **Increasing management responsibility** placed on industry requires that Air Force-industry relations reach a new high in mutual understanding and team work. Only through a maximum increase of our joint efforts can we reach the goals vital to our national interests.

Our increasing reliance on electronics in the future will be greatly influenced by the ability of industry to meet these challenges.

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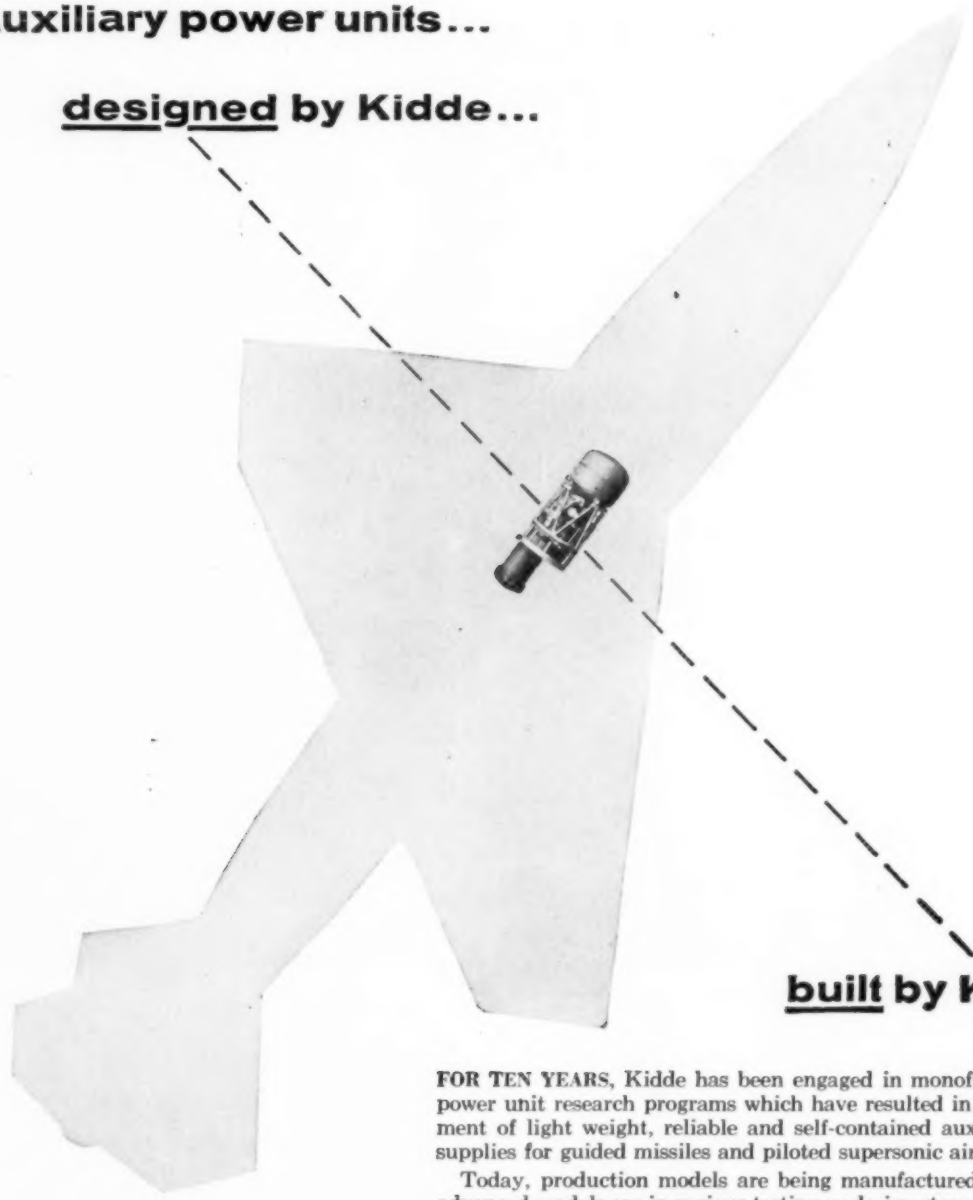

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WHO'S WHERE

In the Front Office

Henry F. McKenney, vice president-engineering, Electronics Corporation of America, Cambridge, Mass.

Dr. W. R. G. Baker, consultant to executive vice president-Electronic, Atomic and Defense Systems Group, General Electric Co., Syracuse, N. Y. Dr. Baker is a GE vice president.

Gaston Dieu, assistant to the president, Sabena Belgian Airlines.

Frank L. Marshall, vice president-general manager, West Coast branch, Aerovox Corp., New Bedford, Mass. Also: **Robert A. Hoagland,** vice president-manufacturers sales; **James Luther,** vice president-engineering; **Louis Kahn,** technical assistant to the president.

Charles S. Allen, Jr., president, Airpower Overhaul, Inc., Oakland, Calif., and **Edward E. Wendt,** vice president.

W. H. Carlson, Stuart N. Smith and **George R. Hecht,** vice presidents, Twin Coach Co., Aircraft Division, Buffalo, N. Y.

Brig. Gen. Otis O. Benson, Jr., Commandant, USAF School of Aviation Medicine, San Antonio, Tex.

Robert J. Smith, vice president-sales and traffic, Slick Airways.

Honors and Elections

Fred Hyatt, chief weights engineer, Republic Aviation Corp., Farmingdale, N. Y., received a fellowship from the National Society of Aeronautical Weight Engineers.

I. Edward Garrick, National Advisory Committee for Aeronautics scientist, was named to fill the Jerome Clarke Hunsaker professorship at Massachusetts Institute of Technology for one year.

Joseph A. Strollo, executive pilot for Suburban Propane Gas Corp., received the New York Department of Marine & Aviation Distinguished Service Award for rescuing a child with the firm's helicopter from New York's East River June 12.

D. T. Wellman, president, Wellman Bronze & Aluminum Co., Cleveland, Ohio, re-elected president of the Magnesium Assn.

Changes

Joseph P. McNamara, manager, Neosho, Mo., plant of North American Aviation, Inc.'s Rocketdyne Division.

H. R. Senf, in charge of experimental systems section, Electronics Department, Research and Development Laboratories, Hughes Aircraft Co., Culver City, Calif.

Henry V. Beuttell, general manager, Republic Aviation (International) S. A., Lugano, Switzerland.

Vincent Matner, chief product engineer, Fischer & Porter Co., Hatboro, Pa.

Don C. Shearer, operations supervisor, Aircoach Transport Assn., Washington, D. C. and **James J. Kennedy,** overseas traffic supervisor.

Jack R. Norris, manager, service department, Cleveland Pneumatic Tool Co., Cleveland, Ohio.

Frederick M. Spuhler, passenger sales director, Trans World Airlines.

INDUSTRY OBSERVER

► More than 12 earth satellites may be planned by the U. S. for launchings during the International Geophysical Year. Latest Navy contracts call for as many as 35 of some components for the satellite and its vehicle. Two different sizes of satellite—six and 20-inch diameter—are contemplated.

► **Fabrication of flexible cylinders of 0.002 in. stainless steel is being studied by Cambridge Corp. Welding methods developed by Cambridge could be applied in fabrication of a 3 ft. diameter steel balloon such as that suggested for the recovery of data from an earth satellite (AW May 14, p. 53). Cambridge also suggests that aerodynamic heating could be utilized to vaporize water with resulting steam inflating the balloon. This could eliminate the need for a helium container in the satellite package and would provide cooling for the balloon on re-entry to the earth's upper atmosphere.**

► Defense Department estimates that, under the present B-52 program, the Air Force will have 500 of the Boeing Stratofortresses by October 1958.

► **Air Research and Development Command has awarded the Consolidated Electrodynamic Corp., Pasadena, Calif., a $1.2 million contract to provide magnetic-tape instrumentation along the USAF's planned 5,000-mile missile test range which will extend from Florida across the Atlantic to Ascension Island off the African coast.**

► Army is considering ways and means of firing guided artillery missiles from helicopter platforms.

► **Army Corps of Engineers will construct a laboratory for research into feasible missile countermeasures at White Sands, N. M.**

► Air Materiel Command has awarded Lockheed Aircraft a $1 million implementation-program contract for a reconnaissance version of the F-104.

► **Lt. Gen. James M. Gavin, Army chief of research and development, has confirmed reports that the Soviet Union has "fired an object that must have been a rocket for several hundreds of miles in some numbers."**

► Pentagon reportedly turned down a request by the U. S. Air Force in Europe for its own unit of Douglas C-124 transports. The Pentagon says Globemasters will be based only within the U. S. to carry out global missions.

► **Magnetic overheat and fire-detection system will be offered shortly by Sperry Gyroscope. The "ultra-light" weight unit will have uniform sensitivity adjustable for all heat settings to over 1,000 degrees and can be used in any location on piston or jet aircraft.**

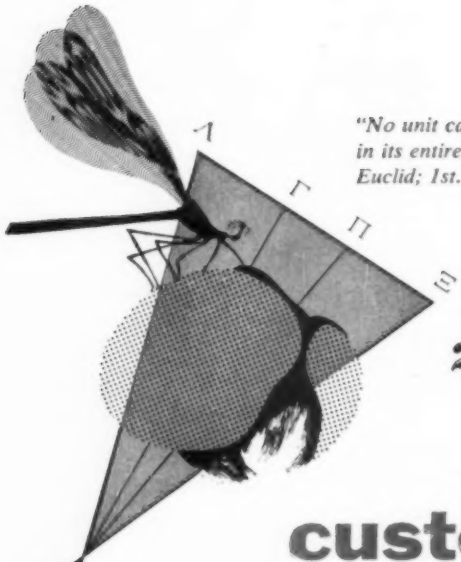
► McDonnell's F-101A has been flown at a maximum gross weight of 49,000 lb. during its flight test program at Edwards AFB.

► **Gyroscopic forces created by the large rotating mass in a turbojet engine are being felt seriously for the first time in Ryan's vertical-takeoff-and-landing X-13 because of the relatively heavy rotating mass as compared with the aircraft's unusually-light airframe.**

► Sncase SE210 Caravelle flew from Algiers to Paris in three hours, 13 minutes, on one of its route-proving trials for Air France. Powered by two Rolls-Royce Avon jet engines, the Caravelle has taken off within 6,560 ft. on one engine with an all-up weight of 72,500 lb.

► **Army aviation is expanding fast in Europe, will soon have its own supply depots located at strategic points.**

► Highest current efficiency for the conversion of solar energy is running at about 12% using semi-conductors in a solar battery. Applications to aircraft as prime powerplants still appear distant, but possible ground uses in areas of little or no cloud cover may not be too far away.



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Euclid; 1st. theorem of optics.

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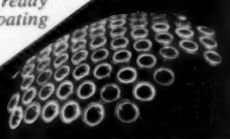

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WASHINGTON ROUNDUP

Chinese Rockets and Murphree

An example of the artlessness with which the Pentagon sometimes approaches public relations was exhibited in a speech written for Eger V. Murphree, Defense Secretary Wilson's special assistant for guided missiles, for delivery before the American Rocket Society's semi-annual meeting.

Murphree's first public address in his new position, made before a society whose membership is made up of professional scientists and engineers working in the fields of jet propulsion, rockets and guided missiles, consisted largely of an elementary presentation of the history and development of rocketry, drawn for the most part from the Encyclopedia Britannica. Approximately one-fifth of the speech was devoted to the historical background of guided missiles, beginning with Chinese rockets of the Thirteenth Century. The remainder was an elementary presentation on different types of guidance and propulsion systems. Murphree concluded that guided missiles undoubtedly are complex.

The less-complex American Rocket Society was simply perplexed.

Wilson's Hot-Water Tea Party

Defense Secretary Charles E. Wilson, more noted as an industrialist than as a man of tact, hustled off for two days of Canadian fishing last week, leaving Washington in an uproar for which he admittedly was largely to "blame."

Earlier, during a three-day meeting of 160 defense leaders at near-by Quantico, Va., Wilson had managed to dabble his feet into hot water by:

• **Denouncing as unnecessary** a Republican-sponsored proposal for a $500 million increase in the USAF's Fiscal 1957 budget after the measure apparently had received the tacit approval of President Eisenhower (AW June 25, p. 26).

To make matters worse, the semantically-inept Secretary used the word "phony" during a discussion of the merits of the Republican bill and the Democratic counter-proposal for a $1.16 billion increase. Newsmen interpreted the word as being applied to both Republican and Democratic efforts to increase the budget. Wilson later denied that it was directed at either, but a Senate storm already had broken (see page 30).

• **Issuing a directive** ordering all military officers in the Washington area to wear civilian clothes while on duty after July 1. Wilson's feeling was that the military was too much in evidence in the nation's capital and would do better to disguise itself. Feeling in the Pentagon, particularly among junior reserve officers, was that the order represented a severe financial blow (the extent of many an officer's civilian wardrobe is week-ending sports wear).

President Eisenhower agreed, and, one day after the original directive, Wilson modified his order to make the wearing of civilian clothes "optional."

• **Declaring that the Air Force** has "plenty of men to do its job" and that the Army can be made "more effective" with fewer men. Even Army Secretary Brucker seemed surprised. In reply to a question over proposed cuts, Brucker said, "Nobody has taken it up with me yet."

He added that he feels "rather strongly" that the present Army is about the right size.

This completed, and obviously feeling he had done enough, Wilson decided to call off a scheduled press conference on the last day of the Quantico meeting. He seemed destined, however, to run into even more trouble later in the week when he was to appear before Sen. Stuart Symington's Senate Airpower Investigating Subcommittee.

Budget Cripples Missile Defense

Hardly had Secretary Wilson made his stand-pat pronouncement than Gen. Thomas D. White, USAF vice chief of staff, warned defense leaders at Quantico that "we have not made adequate progress toward developing a defense" against the intercontinental ballistic missile. Gen. White said the Soviet Union could have large numbers of nuclear-tipped ICBMs by 1960 and added: "A co-ordinated effort to provide an effective missile defense is one of the most critical requirements in our national security." Under the USAF budget proposed by the Administration, $2 million had been scheduled for the project seeking a direct defense against long-range ballistic missiles.

The Air Force originally had asked for $34.4 million (AW June 25, p. 27).

Wilson's R. S. V. P.

On yet another front, Secretary Wilson declined an invitation to testify before the House Information Subcommittee on July 5 and assigned Robert Tripp Ross, assistant secretary for legislative and public affairs, to appear in his stead. Wilson, however, may be in for a "re-invitation."

If the subcommittee, headed by Rep. John E. Moss (D.-Calif.), isn't satisfied with Ross' answers it will try again to get Wilson. It wants to question him on his remarks regarding the recent flare-up of the interservice feud, and on statements some time ago regarding the philosophy of a former aide, R. Karl Honaman, that only "constructive" military information should be released to the public.

Subcommittee also wants to question Admiral Arthur Radford on his remark that the nation's press "confuses" our allies.

Also scheduled to be called are Defense Department research and development, public information, legal and intelligence representatives.

Vis-a-Vis

At open sessions of the Senate Airpower Investigating Subcommittee, Chairman Sen. Stuart Symington (D.-Mo.) is insisting that testimony given during closed hearings paints an even darker picture of U. S. airpower than that which has been disclosed. Republican Sen. James Duff (Pa.) maintains just as strongly that the closed-session testimony, describing "fantastic" and "fabulous" developments, are cause for great optimism.

On another matter, Symington is thoroughly pleased with the security review of executive sessions being conducted by Adm. Arthur Davis. Symington says the principal reason for the sometimes long delay in the release of cleared testimony is the small size of his own staff.

—Washington staff

Soviets Show Twining Eight New Planes

USAF chief of staff views 1,200 mph. Super Farmer, three all-weather, delta-wing fighters in Moscow.

By Robert Hotz

Moscow—The Soviet air force, displaying its might before USAF Chief of Staff Gen. Nathan F. Twining and top Air Force research and development experts, revealed eight new military aircraft to western observers here during the last ten days.

Five of these were shown publicly before 300,000 spectators packed into Moscow's Tushino Airdrome for the show celebrating the Soviet National Aviation Day.

The other three were displayed for the Twining party on the ground at Kubinka Military Airdrome near here.

New aircraft flown over Tushino included a Super Farmer day fighter, which is basically larger and much faster than earlier model Farmers now operational in large numbers with the Red Air Force fighter command.

Two experimental-type Super Farmers led the fly-by with low-level, subsonic passes. The new aircraft are powered with larger engines than the earlier twin-jet Farmers which now can be definitely identified as the MiG-19.

Thermal Problems

Indications are that the Super Farmer with a top speed of over 1,200 mph., is encountering thermal problems.

The new fighter is believed to be a Mikoyan design, indicating a stretch out of the basic Farmer development similar to that of the MiG-15 through 17.

The Super Farmer is of the same general size as the Flashlight (a Yakovlev design) but with more wing sweepback, a cleaner design and more-powerful engines. Two versions were in the Tushino fly-by; one with a needle-nose, gray radome, indicating an all-weather function; the other with a plastic bombardier nose for probable use as a light bomber and with twin axial-flow jet engines slung beneath the wings but not podded.

Despite the subsonic passes over Tushino, a supersonic performance capability for the aircraft was evident from the design.

In another fly-by, three all-weather, delta-wing fighters of two different designs swept over Tushino at subsonic speeds. All three, however, exhibited fast rates of climb.

The fuselage of one of the aircraft designs extended aft of the delta wing and was equipped with a conventional vertical-and-horizontal tail. The delta aircraft has a fuselage bulge just aft of the trailing edge of the wing and forward of a conventional empennage that suggests the area rule concept may have been applied in its design. The other delta-wing design embodied a vertical fin similar to that of the Convair F-102 plus a horizontal stabilizer mounted midway up the fin.

All three planes had small, needle-nose radomes with the air intake located directly below as on Chance Vought's F8U Crusader.

The aircraft, somewhat smaller in size than the F-102, have extremely thin wings with a 65 degree sweepback. Their design was credited by the Russians to Pavel Sukhoi, a new name to the West.

Turboprop Assault Transport

The new Soviet assault transport displayed over Tushino is powered by two turboprop engines, each pulling an equivalent of 4,000 horsepower. The turboprop was credited to the designer Anatov, but it is apparent that considerable credit also belongs to Mike Stroukoff, designer of the Fairchild C-123 assault transport, and to Lockheed engineers who fashioned the C-130 Hercules.

Engine nacelles of the high-wing aircraft extend well forward of the leading edge. The engines themselves are extremely quiet, producing no more than a purr even when the aircraft is flying directly overhead.

The box-car fuselage, with its upswept tail and rear door for unloading, is reminiscent of the Stroukoff design; the landing gear, housed in fuselage bulges, is characteristic of the Hercules.

The Anatov transport is larger in size than the C-123 but smaller than the Hercules.

Its appearance, plus advanced helicopter techniques displayed at Tushino, indicates that the Soviet army (like its U.S. counterpart) is interested in a high-degree of air mobility. The transport also is scheduled to see service as a cargo transport with Aeroflot, Russia's state-owned airline.

Kubinka Display

The aircraft at Kubinka were seen by Gen. Twining and his party on the day following the air show. With him were Lt. Gen. Donald L. Putt, USAF deputy chief of staff for research and development; Lt. Gen. Thomas S. Power, commander of the Air Research & Development Command; Maj. Gen. Al Boyd, deputy commander of ARDC for weapons systems; Lt. Gen. Frank F. Everest, deputy chief of staff for operations; Lt. Gen. Clarence S. Irvine, deputy chief of staff for materiel, and Brig. Gen. William H. Blanchard, deputy director of operations, Strategic Air Command.

New aircraft seen at Kubinka included a swept-wing light bomber approximately the size of the Martin B-57 and said by Soviet air force officers to be supersonic.

The bomber, powered by twin axial-flow jet engines, appeared over Moscow during rehearsals for the Tushino show but was missing from the actual fly-by. External inspection permitted the Twining party indicated that the bomber, a prototype, probably was grounded because of mechanical trouble.

The aircraft is believed to be the potential successor of the Ilyushin 28,

Soviet Forecasters

Moscow—The Soviet air force has an excellent weather-forecasting system, if its performance at the Tushino air show is any indication although, initially, it looked as though the forecasters were off to a bad start.

The time of the show was advanced from noon to 10 a.m. because of weather forecasts, but heavy morning showers drenched crowds pouring towards Tushino in open trucks.

But the rain stopped almost at the finish of a 21-gun salute which marked the show's opening, leaving a 10,000-ft. overcast with ample room for jet maneuvering. Before the end of the show, the sun was shining through brightly.

Khrushchev Prefers Airmen

• Moscow—Nikita Khrushchev, the Soviet Union's Communist party chief, believes airmen make better military leaders in the world of today than Navy admirals.

At a Moscow reception for Gen. Nathan F. Twining, USAF chief of staff, and air force leaders from 28 other countries, the Communist-party boss twitted Twining by asking why the U. S. had an admiral as chairman of its joint chiefs of staff. "Admirals," Khrushchev said, "are always looking backward and living in the past."

a straight-wing, subsonic plane that has been the standard light bomber for the Soviet and satellite air forces since 1950.

The new design also was credited to Ilyushin.

A second design seen by the Kubinka group was a heavily-armored army jet attack plane equipped with externally-slung racks for rockets and bombs. It probably was designed to assume the modern-day role carried out by the Stormovik during World War II.

The third new aircraft seen at Kubinka was a turboprop navy plane with contra-rotating propellers designed for anti-submarine duties and bearing a similarity to Britain's Fairey Gannet but with cleaner lines.

Giant Transport

Missing from both Tushino and Kubinka was a four-jet transport version of the Bison heavy bomber which most western observers had expected to see beforehand and which the Russians say is under construction.

Designer Andrei Tupolev, interviewed by AVIATION WEEK during a reception for Gen. Twining given by Soviet Defense Minister Georgi K. Zhukov, said the prototype of the 170-passenger transport is now nearing completion but has yet to make its first flight.

Tupolev said he plans to have his giant jet transport ready within two years for service over long international routes and key domestic runs.

The chief of Aeroflot operations, Maj. Gen. Beletsky, said work also is progressing on a new turboprop transport, the Ilyushin 18. Its prototype, Beletsky said, is rapidly nearing completion.

The aircraft has a low-mounted swept-back wing, will carry 70 passengers and be powered by four turboprop engines.

It also is likely that a turboprop transport version of the Bear is under development. When queried if Aeroflot plans civil developments of all current military bomber types, designer Tupolev replied that this was a logical development plan.

Tushino Aerobatics

At Tushino, most of the flying was done beneath a 10,000-foot overcast that finally broke into sunshine. A stiff 20 mph. south wind made parachute jumps difficult and caused the cancellation of a mass drop scheduled from 36 Ilyushin 12 military transports.

The Twining party, top Soviet leaders and air force officials from 28 other countries watched the show from a clubhouse balcony of the Central Flying Club across the road from the grass-runway airdrome.

Most military aircraft in the fly-by

RUSSIAN DELTA-WING all-weather fighter has conventional tail arrangement.

TURBOPROP BEAR BOMBER, led Tushino fly-by; weight estimate: 360,000 lb.

RECEPTION TOASTS were drunk by British Air Secretary Birch, Marshal Zhukov, Prime Minister Bulganin, Khrushchev, and General Twining.

BISON'S AT TUSHINO looked smaller than expected. This four-jet bomber is "definitely smaller" than Boeing's D-52 Stratofortress.

passed almost directly overhead and at low altitude.

For example, the Bear heavy bombers flew over at such a low altitude observers could read the large operational numbers painted on their nose sections.

The military fly-by was led by a single Bear, piloted by Col. Kharitonov and bearing the nose number, 51. It was escorted by two Fresco fighters flying at its wingtips to indicate comparative size.

360,000-lb. Bear

The first, and strongest, impression is the enormous size of the Bear, which must have a gross weight of 360,000 lb. and a speed of 500 mph. Its high-aspect-ratio wings indicate excellent high-altitude performance, and each of its four turboprop engines develops the equivalent of 12,000 horsepower.

In the fly-by, armament bulges and radar were clearly visible in the large inboard nacelles which also house the landing gear. Tailpipe exhausts for the turboprops were located on the underside of the nacelles.

Russian leaders doubtlessly placed the Bear as the lead plane in the military demonstration because of earlier USAF testimony that the bomber is the Soviet's first intercontinental aircraft.

The initial Bear and its Fresco escort were followed by a formation of three Bears bearing nose numbers in the 40s. These, in turn, were trailed closely by three Bisons.

The Bison

The Bison, smaller than its pictures had indicated, is definitely smaller than Boeing's B-52 Stratofortress. Following the Bisons were nine Badgers flying in V formations of three each. Externally, at least, they revealed little new.

Next came 50 Flashlights streaking by in V formations of five planes and led by Col. Vovk. The Flashlight, a slimmer, faster aircraft than pictures had indicated, has a large, gray radome nose; its tail fairing indicates that armament may be housed there. The vertical fin of the Flashlight is sharply swept back with the horizontal stabilizer mounted midway up.

Following the Flashlights were 60 Farmers, an extremely fast fighter in the 900-mph. class, led by Lt. Col. Stepanov. The Farmer, powered by two axial-flow engines believed to be of by-pass design, has a high-aspect-ratio, 60-degree sweptback wing and a large, round air intake for high-altitude performance.

The twin tailpipes of the Farmer are visible; fuselage is flatter than earlier descriptions but broad to contain its double-engine installation. The aircraft's horizontal tail is set low, just below the fuselage line, in contrast with the high tails of all other Soviet jet fighters seen.

The fighter formations of the Farmers as they passed over Tushino were extremely tight and evidenced a high degree of pilot training.

Helicopter Assault

The finale of the show was a mass air assault against Tushino airdrome by 30 Hound and four Horse helicopters carrying trucks, artillery and jeeps.

It was less than eight minutes from the time the helicopters appeared on the horizon to the point when ground troops had set up the disgorged equipment and were ready for action.

Later, six Hounds paced their way through a tight, precise formation-flying exhibit that could be compared in quality with that of a crack rifle drill team.

The Hound, larger than a Sikorsky S-55 and bearing a resemblance to the S-58, has two triangular horizontal stabilizers midway back on the tail boom and carries an air evacuation pod beneath the main cabin. The Horse, however, appeared unstable in the gusty winds.

Soviet Acrobatics

The military fly-by was preceded by acrobatic demonstrations by sport pilots flying Yak 18 monoplanes and by military pilots in Farmers and Frescos.

One of the Farmers, flown by Lt. Col. Pavlov, employed smoke trails (in the manner of U.S. stunt teams) to mark its path during the aerial demonstration.

The best flying of the day came from

Soviets Push Transports

Moscow—The Soviets are pushing hard to step up their production of aircraft.

Western observers in Moscow for the Tushino air show visited a plant near Moscow where Ilyushin 14s are rolling off the line at a rate of 30 a month. The plant employs 5,000 workers for a single-shift operation and builds the complete aircraft—including instruments, seats and lavoratories—except for the engines and electrical equipment.

four Farmers commanded by Col. Solovyov flying in a diamond formation.

However, its repertoire was not as elaborate, nor its execution as precise, as that of either the USAF Skyblazers or the Navy's Blue Angels.

Another fine demonstration in precision formation flying was performed by nine Frescoes flying in V echelons of three each within a larger V formation. Throughout the demonstration, the nine managed to maintain the same formation while carrying out a series of acrobatics.

The only mediocre stunting of the day was done by formations of five Frescoes and six MiG-15s.

Twining Visits Soviet Factories, Views Production of Nene Engine

Moscow—The Russian visit of Gen. Nathan F. Twining, USAF chief of staff, and top air force officials from 28 other countries marked the first major crack in the Iron Curtain that has screened the Red air force since even before World War II.

As official guests of the Soviet air force, the Twining party was permitted to visit two aircraft plants, tour an operational military airfield, spend most of one day at the Zhukovsky Air Engineering Academy and mingle with top Soviet political and military leaders at the Red Army Club reception given by Soviet Defense Minister Georgi K. Zhukov.

The group also toured Engine Plant No. 45 near Moscow where the Russian version of Britain's Nene jet engine has been produced since 1948.

The Soviets are now phasing out production of the Nene at the plant, and a shift to higher-powered axial-flow engines is well under way.

Russian Nene

Engine designer Klimov told the Twining party that present production models of the Nene can produce a thrust of 6,000 lb. dry and 7,000 lb. with afterburner (approximately the same as that of the Pratt & Whitney J48). The Nene, or Klimov engine as it is called here, is used to power the MiG 15 and 17.

In addition to Klimov, Gen. Twining's group was escorted through the plant by manager Kuindzki, who told Lt. Gen. Clarence S. Irvine, USAF deputy chief of staff for materiel, that approximately 30% of the workers at the factory have been employed there for at least 10 years.

Machine tools in the plant had been manufactured in a number of nations, including the U. S. and Germany.

At present, a total of 3,000 workers at the plant are engaged in production of the Nene.

Other parts of the factory, however, are engaged in the manufacture of farm machinery.

Dual-Purpose Plants

The ability to serve a dual purpose seems to be a characteristic of the older Russian aircraft factories, with the emphasis shifting to military or civil production as the situation requires.

Engine Plant 45 is where the original Russian Nene was developed and put into production after purchase of "sample" engines from the British.

At Moscow Central Airport, the Twining party visited Aircraft Assembly Plant 30 where Ilyushin 14 transports are manufactured. Gen. Twining reported that the Il 14 is being produced in both 18- and 24-seat versions and achieves an estimated cruise speed of 200 mph. on two 900-horsepower engines.

Soviet officials said Plant 30 is the oldest aircraft factory in their country.

At Zhukovsky, the USAF officers were shown cutaways of engines and airframes and supposedly supersonic wind tunnels. They also received a thorough briefing on the Soviet air engineering curriculum.

No Military Production Seen

They did not see, however, any military aircraft production. Nor did they see axial-flow jet engines such as the Lulko which powers the Badger and Bison, nor large turboprops such as those used on the Bear and the new Anatov transport.

After his visit to Zhukovsky, Gen. Twining said the air engineering academy offered an extremely thorough course for the training of aeronautical engineers, one which the U. S. could not duplicate.

At Marshal Zhukov's reception, top Soviet political leaders, including Communist party chief Nikita S. Khrushchev and Prime Minister Bulganin, and military leaders such as Marshals Sikolossky, Zigarev and Budenny mingled freely with the foreign guests, chatting informally, offering toasts and boating in the lagoon.

Twining's Answer

In response to Soviet toasts to disarmament and pointed references to the recent Red army cutback, Gen. Twining replied that the U. S. has no military ambitions and pointed out that it entered its last three major wars "late" and unprepared.

He also noted that, after World War II, the U. S. stripped its military machine to the bone in a "real disarmament" and had to build up practically from scratch at the beginning of the fighting in Korea.

Now that the U. S. is strong again, Gen. Twining said, it will remain that way until other nations show they are prepared to accept a genuine disarmament such as the U. S. underwent after World War II.

The official reports of Gen. Twining and his party will be made to Defense Secretary Charles E. Wilson and President Eisenhower upon their return. There is no doubt, however, that they view the trip as being particularly valuable in establishing contact with Soviet air force leaders and in helping them to understand the aviation development in the Soviet Union.

There also is no doubt that the Soviets recognize the full implications of the air age and are pushing all out to take full advantage of it, not only in the military but also in the field of civil aviation.

Tu-104 to Canada?

Moscow—Russia is considering flying a Tu-104 twin-jet transport over the polar route to Toronto for the Canadian National Air Show which begins Sept. 3.

Edgar Alberts, president of the Royal Canadian Flying Club, here to complete negotiations for the flight, says only technical details now stand in the way of formal Soviet approval.

There also is a possibility that the Russians would accept an invitation to fly a Tu-104 to Oklahoma City for the National Aircraft Show to be held over the Labor Day weekend.

PAA Officials to Moscow

Moscow—Pan American World Airways last week informed Aeroflot, Russia's state-owned airline, that its technical delegation is ready to travel to Moscow for operational discussions regarding proposed routes for the U. S. airline into the Soviet capital. If successful, the discussions will be followed by top-level negotiations between officials of the two carriers.

The technical delegation, headed by Harold Gray, Pan American's Atlantic Division chief, probably will fly to Russia sometime early this month. The proposed routes would carry Pan American into Moscow from Berlin and Helsinki.

Senate Votes Boost in Air Force Budget

By Katherine Johnsen

Washington—The Senate last week voted an $800 million increase in Air Force procurement funds for Fiscal 1957, $450 million more than the Administration had tacitly agreed to accept, after lengthy debate that included Democratic demands for the resignation of Defense Secretary Charles E. Wilson.

In the vote 43 Democrats and five Republicans supported the proposal; it was opposed by 37 Republicans and three Democrats. Most of the new funds will go towards the procurement of B-52 intercontinental bombers.

The action followed the defeat of an Administration-endorsed Republican amendment that would have boosted the Air Force allocation for aircraft procurement by $350 million.

The Senate also voted a $100 million increase in USAF research and development funds. This increase had almost unanimous support.

Attacks Against Wilson

The deluge of Democratic criticism hurled against Wilson almost wholly without Republican challenge was touched off by newspaper reports quoting the Secretary as saying that Senate attempts to increase the Air Force budget were "phony."

Wilson declared that his remark had been misinterpreted, but it was enough to rekindle smoldering resentment against the Defense Secretary who got off to a bad start in his initial appearance before the Senate Armed Services Committee in February, 1953. At that session, he particularly angered committee members by referring to them as "you men."

In last week's debate, Senators Richard Russell (D.-Ga.), chairman of the Armed Services Committee, and Sen. Stuart Symington (D.-Mo.) demanded flatly that Wilson be removed from office.

Republican Senators were quiet, and one, Sen. Styles Bridges (N. H.), former chairman of the Appropriations Committee, joined in the chorus. Bridges declared:

"I wish to say that I read with amazement and shock the statement of the Secretary of Defense, in which he describes the efforts of members of the Senate as 'phony.' I feel there is an honest difference of opinion between Senators, but I believe all of them are attempting sincerely to fulfill the objective of providing the ultimate security for America. I consider the statement of the Secretary of Defense . . . to be an unwarranted slur upon Senators; and I wish to be registered as emphatically saying so on this floor."

The generally mild-mannered Russell, urging the $800 million increase as a "minimum," declared: "It is a great tragedy . . . I say that it is dangerous . . . to have a man so completely inept and un-equipped for this responsible position occupy the office of Secretary of Defense."

Russell's Charge

Russell said that over the past few years he has been "sorely tried by the Secretary of Defense." Were Wilson a member of his own party, he said, he would have expressed his "resentment" earlier. He had previously held back, he said, because he felt his criticism might be construed as political, in the area of national defense. Russell continued: "I exercised forebearance and such patience as I had. But patience ceased to be a virtue."

He charged that Wilson has treated Senators with "disdain, at times almost with contempt;" that the Secretary has "dictated without regard to law or the Constitution of the U.S.," that he has "sought to intimidate officers," and that his "vanity and arrogance are surpassed only by his lack of understanding of the American system of government and its division of powers."

Russell also protested that "everytime he (Wilson) has come in and asked for a reduction (in the armed services), he has come in and asked for more assistant secretaries." (The number of assistant secretaries has mushroomed under Wilson's administration from 17 to a proposed 33.)

No Support by Knowland

Immediately following Russell as a Senate speaker, the Republican minority leader, Sen. William Knowland (Calif.), supported the $350 million—rather than an $800 million—increase in USAF procurement funds and opened his remarks with praise of Russell, declaring that "there is no one more devoted to the national defense." Knowland pointed out that he previously had served on the Armed Services Committee under Russell's chairmanship and said that the Georgia Democrat had headed the group "not as a partisan."

Knowland made no mention of Wilson nor of Russell's attack.

Sen. Symington concluded a lengthy, documentary speech on Wilson by concluding: "I believe a majority of the Congress and the American people will agree that the usefulness of this Cabinet officer has come to an end."

Although highly partisan, the Senate debate on Air Force funds was in a spirit of compromise and included these steps:

Senate Debate

• **Senate Appropriations Committee** voted an amendment, offered by Sen. Dennis Chavez (D.-N.M.), increasing USAF funds by a total $1.16 billion, in five categories:

Aircraft procurement, $800 million.

Research and development, $100 million.

Operations and maintenance, $40 million.

USAF Talos Plans Blocked

Washington—The Senate Armed Services Committee called for the establishment of an "impartial board" to evaluate the competitive Army Nike air defense missile system and the Air Force's Talos system.

Rejecting a USAF request for $16.3 million to begin construction of Talos operational sites, the committee declared that "no objection is made to the continued research and development of Talos," but added that no sites should be constructed "until the relative merits of both systems have been positively tested and the roles and missions clarified." The committee also noted that Talos "promises very high performance."

The committee did grant $136.7 million for Nike and conventional anti-aircraft Army facilities, explaining that this system "is currently in being and there exists no other system at the present time that can do the job for which Nike was designed." Approximately $886 million has already been spent on the system, and the Army estimates that "an additional $5 to $6 billion might be required over the next few years to include the latest technical developments of new Army missiles designed to be integrated into the Nike system.

Pointing out that the Nike-Talos system and the SAGE (Semi-Automatic Ground Environment) and DEW (Distant Early Warning) systems programs are all multi-billion-dollar projects, the committee questioned whether "there might be a dangerous trend toward a 'Maginot Line' type of thinking" and "whether the military posture of the nation might as a result be limited in offensive capabilities."

Personnel, $20 million.
Bases, $200 million.

The vote was 13 to 12. Ten Democrats and three Republicans supported this proposal.

• **The Republican** leadership countered with a proposal offered by Sen. Bridges differing with the Democratic amendment in these respects. It would increase the procurement allocation by only $350 million, the operations allocation by only $30 million, and would allow no money for bases. It proposed the same increases as the Chavez amendment for research and development and for personnel.

• **The Democratic leadership retracted.** Chavez withdrew the $200 million for bases. The only advantage of this increase would have been a saving of time in getting construction under way. Congress will soon consider separate legislation providing funds for all military construction.

The net result of these actions was that the difference between the Republican and Democratic proposals finally put to a Senate vote was reduced to $460 million—$450 million for aircraft procurement and $10 million for operations and maintenance.

The total $16.6 billion USAF budget approved by the Senate is almost $2 billion higher than the Fiscal 1956 budget of $14.7 billion. With the $800 million increase, it provides a total $6.8 billion for aircraft procurement (as compared with $6.3 billion for Fiscal 1956) and $710 million for research and development (as compared with $570 million for Fiscal 1956).

Democratic attacks against Secretary Wilson during debate on the budget also included these comments:

• **Sen. George Smathers** (D.-Fla.): "I do not know when we have had anyone in the government of the U. S. who has managed more often to insult, not only those with whom he must work within his own department, but members of Congress as well. He acts as though he knew more about this particular problem than such well-qualified men as Gen. (Curtis) LeMay and other outstanding American patriots who have spent their lives in this particular field and who testify just the opposite of what the Secretary is trying to tell the American public."

• **Sen. Sam Ervin** (D.-N.C.): Referring to Wilson's observation that the public is not inclined to increase in defense spending that entail tax increases, Ervin said: "From my observation, the American people are not only giving their sons to the defense of their country, but they are also giving their dollars, and since I came to Washington two years ago I have not heard any American citizen other than the Secretary of Defense complain about any appropriation for defense purposes."

• **Sen. Dennis Chavez** (D.-N.M.): "The difficulty of the Secretary of Defense is that he forgets he is not running General Motors Corp. but is working for the public. He cannot get over the idea that, notwithstanding his success with General Motors, as a public servant he is behaving as a child. Every time he holds a conference, his limbs become so limber that, as the proverbial saying goes, he puts his foot in his mouth."

• **Sen. Henry Jackson** (D.-Wash.): "The Pentagon politicians have reversed themselves twice. Back in May, 1955, even after the Moscow fly-by, Secretary Wilson told a press conference he thought no more B-52 funds were needed. But in June, less than a month later, he asked for about one quarter billion more for B-52s.

"In March of this year, Secretary Wilson told another press conference he thought no new funds for B-52s were needed. But in April he changed his tune again and asked for about one quarter billion more.

"This is why I cannot be surprised at the attitude of Secretary Wilson toward the $800 million increase now recommended.

"It fits the pattern of error which has marked his approach to our military problems."

• **Sen. Willis Robertson** (D.-Va.): Robertson said that at times he has been "forced to the conclusion that our distinguished Secretary of Defense had been operating in a vacuum, suspended. . . ."

The five Republicans who voted with Democrats for the $800 million increase in aircraft procurement funds were: Francis Case (S. D.), George Malone (Nev.), Joseph McCarthy (Wis.), Margaret Chase Smith (Me.) and Herman Welker (Ida.).

Quarles Denies LeMay Testimony; Says U.S. Will Retain Superiority

Washington—Air Force Secretary Donald A. Quarles last week challenged the testimony of Strategic Air Commander Gen. Curtis LeMay that, under the Administration's present program, U. S. strategic air superiority will pass to Russia in the 1958-60 period.

In sworn testimony before the Senate Airpower Investigating Subcommittee, Quarles said "we will still be superior, considering B-47s, missiles and other elements." This opinion is shared by the Air Force Chief of Staff Gen. Nathan Twining and Vice Chief of Staff Gen. Thomas D. White, Quarles said.

"The B-47 aircraft provides practical performance characteristics over the target which are only moderately inferior to those of the Bear or Bison type bombers," Quarles testified. "In 1959, the B-47 with tanker support will remain the largest force of intercontinental bombers in the active inventory of any country. It is true that our large fleet of B-47s would be more effective if supported by the new all-jet KC-135 tanker; but it is also true that the KC-97 tanker permits effective intercontinental operation of B-47s without the use of our complex of overseas bases."

Quarles also challenged the testimony of Lt. Gen. Donald Putt, deputy chief of staff for research and development, that USAF's research and development program has been kept at approximately the same level for the past few years and that this level is inadequate.

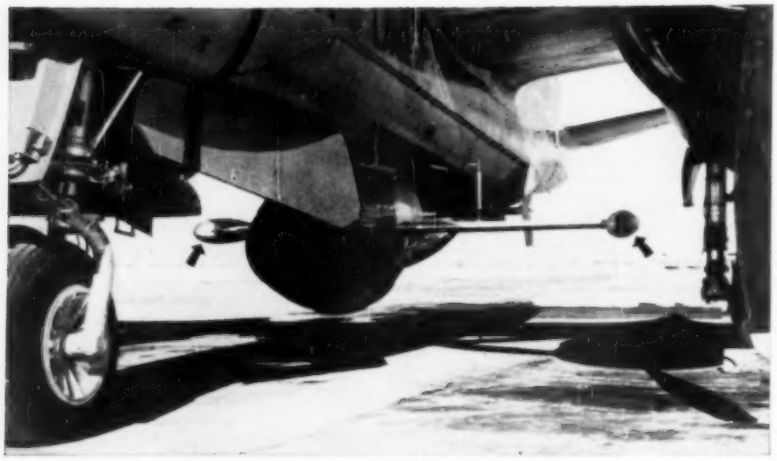
Quarles said there has been "a steady increase over the last several years." The Administration's program for Fiscal 1957 would "provide for all top priority projects essential to the maintenance of a strong deterrent position," he said. But he qualified that by saying "all of us in the Air Force would feel more comfortable if the program were more extensive," and he endorsed the additional $100 million voted by the Senate for research and development.

Subcommittee Chairman Stuart Symington (D.-Mo.) protested that Quarles' statements "do not comply with the sworn testimony of field commanders" and are "inaccurate." Quarles retorted, "I resent that. I would not give false testimony."

Navy Secretary Charles S. Thomas, despite persistent prodding from Sen. Symington, refused to waver from his 100% endorsement of the Administration's naval program. Symington finally charged that, on the basis of the executive testimony of top naval officers, the Russian submarine threat "is not being recognized" and "Naval air is not being modernized as rapidly as necessary."

Thomas said the Navy is "far out ahead of anyone else in the missile field." Although the Navy's carrier attack aircraft, with a range of over 1,500 miles, can reach almost any target on the face of the globe, Thomas recognized they do not have the capability for "large-scale strategic bombardment."

Army Secretary Wilber M. Brucker told the subcommittee that Army's Fiscal 1957 budget was "a minimum austere budget" and that increases in Army appropriations over the next four years is "not only inevitable but right."



Radar Reflectors on Firebee

Corner radar reflectors mounted in fiberglas wing pods (arrows) are attached to Firebee wingtips. Reflectors create an image on tracking radar screens of full-scale airplane to provide more realism to drone exercises. Firebee is slung under B-26.

Russian Yak-24 Specs Revealed in Pravda

The Russian Yak-24 "Flying Boxcar" twin-rotor helicopter weighs approximately 35,000 lb. and has a load capacity of about 8,800 lb., according to a Pravda interview with its designer, Alexander Yakovlev.

Standard Russian four-man crew is carried: pilot, co-pilot, engineer-mechanic and navigator-radioman.

Yakovlev said the helicopter is the product of the Main Design Bureau and several design research institutes of the Ministry of Aircraft Production. Biggest problems were in vibration, structural strength and stability and flight control. Yakovlev said these problems were additionally difficult because of the Russian lack of previous experience in comparable design.

These scientists and engineers were named by Yakovlev as being associated with the design: Research scientists I. V. Anan'yev, A. K. Martynov, L. S. Vil'dgrube, B. Ya. Zherebtsov; design engineers N. K. Skryshinskii, I. A. Erlich, P. D. Samsonov, S. Ya. Makarov, K. S. Kol'dysheva, G. I. Ogarkov and S. A. Bemov.

Tipton Asks State Dept. Policy Review

Washington—Stuart Tipton, president of the Air Transport Association, last week called on the State Department to review its handling of foreign aviation policy and urged that U. S. flag carirers be represented at international conferences on transport matters.

Tipton told the Washington Aero Club that within the State Department, "Aviation seems to have been reduced to a rank below that which it deserves."

Foreign delegations, he said, include airline representation since most foreign-flag airlines are wholly or partly owned by their governments. Under the present situation, U. S. airlines may or may not have such continuous representation in negotiations.

"The unfortunate result of this arrangement is to make the foreign delegation the spokesman and negotiator for its airline, with the American delegation becoming sort of mediator between American-flag and foreign-flag interests," Tipton said.

Examiner Approves Merger of Local Lines

Washington—A Civil Aeronautics Board examiner has recommended that North Central Airlines be allowed to acquire control of Lake Central Airlines for a merger between the two local-service carriers.

CAB Examiner Paul N. Pfeiffer told the Board it could save more than $400,000 in subsidy by permitting North Central to absorb Lake Central and its routes in Indiana and Ohio.

In his report, Pfeiffer found that Lake Central's route system is too small and has too much trunkline competition to continue operations "without substantial Federal subsidy for the foreseeable future." He said that route extensions would not solve Lake Central's problems, but probably would result in substantially higher subsidy.

Standard employe protective provisions are recommended by the examiner as conditions of the proposed merger. He feels that expansion of service on the merged route systems would allow North Central to absorb all but a few of Lake Central's employes.

Red China Pays $17,300 To Indian Crew in Crash

The People's Republic of China has paid $17,300 to Air-India International for distribution to families of the five crew members killed in the 1955 crash of the "Kashmir Princess" Constellation in the South China Sea. Part of the money will go to three injured crew members who survived.

Eleven other persons—officials and journalists on the way to the Bandung Conference—were killed in the crash of the chartered plane, which resulted from an act of sabotage.

The grants are $4,025 to the family of late Capt. D. K. Jatar, commander; $2,415 each to the families of late Miss Gloria Berry, air hostess, the late K. F. D'Cunha, flight engineer, the late Mr. C. V. D'Souza, flight purser. A sum of $1,205 will be paid to each of the injured members of the crew, Capt. M.C. Dixit, copilot, J. C. Pathak, navigator, and A. S. Karnik, senior inspector, as "comfort money."

Pocketaire Manufacturer Sues Scott Aviation Corp.

Cycle-Flo Co., breathing equipment manufacturer, has sued the Scott Aviation Corp. of Lancaster, N. Y., for $750,000. The Milford, Conn. firm accuses Scott of violating the Federal Anti-trust Laws in spreading false and misleading statements in regard to its product, Pocketaire.

Pocketaire, an artificial breathing device, is used by fire departments, rescue squads and other groups working in dangerous atmospheres.

Cycle-Flo, in its suit filed in U.S. District Court in Buffalo, alleges Scott Aviation entered into unlawful contracts and combinations with dealers and distributors to restrain trade and bring about a monopoly in the sale of artificial breathing devices.

Therm-O-Lab Corp. Sued For Patent Infringement

Los Angeles—Electrofilm, Inc., has filed suit in superior court contending that a missile type heating unit has been appropriated by a competing firm, Therm-O-Lab Corp.

Rights to the unit, a film type electric area heating element involving the use of a ceramic ingredient, are claimed by Electrofilm on the basis of a contract with inventor Ralph Hall. Electrofilm contends that A. R. Booker, formerly general manager of Electrofilm and now president of Therm-O-Lab, conspired to obtain and use the invention.

Commerce Department Failure Charged in Congressional Probe

By L. L. Doty

Washington—Charges that the Commerce Department has failed to assert its leadership in air-traffic-control matters and must accept responsibility for the inadequacy of the present airways system highlighted last week's opening of still another congressional probe into civil aviation.

The House Government Operating Subcommittee heard three witnesses voice almost identical denunciations of the present airways system as obsolescent and dangerous. Clarence Sayen, president of the Air Line Pilots Association, called for the abolishment of the Air Coordinating Committee and said more action and fewer investigations might be one means of solving the air space problem.

The group, headed by Rep. Robert H. Mollohan (D.-W. Va.), is looking into air navigation problems with emphasis upon the Tacan vs. VOR/DME controversy. It also wants to investigate the effect jet transports will have upon present-day airports and airways.

Sayen and William Barclay Harding, former chairman of the Aviation Facilities Study Group, urged the subcommittee to help defeat a legislative proposal that would establish a commission to reorganize federal aviation agencies. Under the proposed bill, the commission would be composed of 16 members drawn from the executive branch, Congress and civilian fields.

Praise For Curtis

Harding said the measure would duplicate the job assigned to Special Presidential Aide Edward Curtis. He lauded Curtis as an "excellent and dedicated man on his way towards getting a solution" to the airways problem.

Sayen also opposed the commission theory and agreed with Harding that a centralized agency should be charged with airspace control and direction. Harding urged the establishment of a "master" airways plan, while Sayen called for independent status for the Civil Aeronautics Administration with a "strong administrator" at its head.

Sayen accused the CAA of failing to "keep up" with airport requirements. He added: "The multiplicity of committees and other groups studying aviation is an outgrowth of the Commerce Department's failure to assert leadership."

Instead of more studies, Sayen said, known solutions to the problems should be implemented at once. These, he said, include:

- **Multiple runways.**
- **Multiple Instrument Landing System units.**
- **Increased use of radar.**
- **Increased acceptance rate** of airports.

Sayen told the committee that the CAA, as an independent agency, should control all military traffic as well as commercial and private flights.

He refused, however, to take any position on the Tacan/VOR issue, asking only that a good common system be adopted. Harding attributed the Tacan dispute to "military secrecy" and said the Defense Department developed Tacan without the knowledge of other agencies which have been working in other directions.

AOPA Testimony

Max Karent, vice president of Aircraft Owners and Pilots Association, testified that the Tacan controversy has set back "by years" the development and adoption of a common system.

Last week, the Air Coordinating Committee announced that it had instructed the Air Traffic Control and Navigation Panel to formulate a plan for the "instrumentation of federal airways with navigational aids to supplement the present VOR and to provide clear channel (Tacan compatible) distance measuring equipment."

Karent also asked the committee to look into an alleged Air Force policy of "secretly offering selected city officials a substantial annual payroll in return for complete surrender of their civil airport to the military and subsequent barring of civil aviation."

A group of eight engineers from Boeing, Douglas, Convair and Lockheed gave the subcommittee their companies' guarantee that jet transports would be less annoying to communities than the long-range piston aircraft of today.

Warren Dickeson, executive engineer of Douglas, assured the committee that jet transports are being designed with the capacity of current airports in mind. He said that most major airports will be able to handle jet transports without major alterations but added a plea that more funds go to the CAA so that the jet age will be unrestricted by any airport limitations.

Missile Range Extended

Washington—The U. S. last week signed agreements that will permit the extension of the USAF missile test range off Florida from its present 1,000 miles to 5,000 miles. The range will now extend from Florida's Cape Canaveral to British-owned Ascension Island in the South Atlantic and provides the space needed for test firings of the intercontinental ballistic missile.

Formal agreements for the 5,000-mile range were signed by Secretary of State John Foster Dulles and British Ambassador Roger Makins. Ascension Island lies roughly half way between South America and Africa.

Britain Proposes Cut In Defense Spending

London—Pending discussion in Parliament and agreement with western allies, Britain has proposed a cut of $141.4 million in defense spending.

Chancellor of the Exchequer Harold Macmillan announced the cut as part of an overall reduction of $212.8 million in government spending.

In the defense reductions, Navy would be cut by $30.8 million, Army by $47.6 million, Air by $24.5 million, and the balance of about $39.2 million would be taken from civil departments.

Main defense saving is to come from abandoning or deferring orders.

Lear Pilots Cessna Into Vnukova Airport

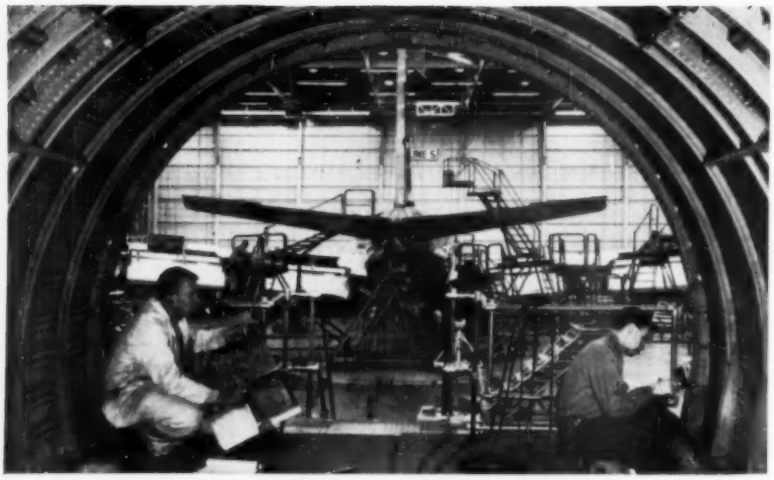
Moscow—William P. Lear, board chairman of Lear, Inc. electronics firm, piloted a specially-instrumented Cessna 310 into Moscow's Vnukova Airport last week to become the first American to fly a civilian aircraft into post-war Russia.

Lear, making the flight upon the invitation of the Soviet Foreign Trade Ministry, was accompanied by a Russian navigator on the one-stop trip from Berlin.

The Cessna was equipped with a Lear-5 autopilot, an automatic approach coupler, several types of gyros and a new Nafli navigation instrument system.

Lear, who will demonstrate his flight-control equipment to Soviet civil-air leaders, says the Russians are "very interested." There is little doubt that they would like to purchase these-type instruments, since there is no indication that their own automatic flight-control systems are nearly so advanced as those Lear will demonstrate.

Richard M. Mock, president of Lear, Inc., stated in Los Angeles, "Neither Lear, Inc., nor its subsidiaries has any desire or intention to sell any of its products to Russia or to its satellites, whether these products are proscribed by embargo or not."



First KC-135 Nears Completion

From the fuselage of the second airplane, the first Boeing KC-135 multi-purpose jet tanker-transport destined for SAC, can be seen as it nears completion at Boeing plant at Renton, Wash. Rollout of the swept-wing craft is scheduled for next month.

News Digest

Orenda Engines Ltd., Toronto, announces it will call its new jet engine, the PS-13, the Iroquois. Engine, developing 20,000-lb. thrust, is to power delta-wing CF-105 jet fighter now being built by Avro Aircraft Ltd. at Toronto for RCAF. USAF has loaned a B-47 to RCAF to use as flying test-bed for the Iroquois engine.

A research, development and technical liaison facility has been established at Boston by the Ramo-Wooldridge Corp. of Los Angeles. The new facility is under the direction of George E. James, former chief engineer of the Laboratory for Electronics, Inc., also of Boston.

Air-India International received the first of three Super-G Constellations scheduled for delivery in 1956 and 1957. The Indian carrier's fleet now includes six Super Constellations and three Constellations.

A $2 million contract for major overhaul of C-97 transports for the USAF has gone into work at Temco Aircraft Corp. at Greenville, Tex. Contract will continue through August, 1957. USAF also has contracted with Temco for overhaul and wing changes in F-84G Republic Thunderjets.

Compania Cubana de Aviacion ordered four Vickers Viscount 810 turboprop airliners for delivery at the end of 1958. New planes will supplement Cubana de Aviacion's initial fleet of three Viscount 700D's.

Japanese government approved two technical assistance contracts between Japanese and American firms. One is for introduction to Ishikawajima Heavy Industries Co. of the manufacture of gas turbines for jet engines by the International General Electric Co. Other is license and technical assistance to the Sumitomo Metal Industry Co. by Cleveland Pneumatic Tool Co. for manufacture and sales of oleo struts for F-86D and F-86F.

A company specializing in renting aircraft to various civil airlines will be set up in Tokyo in early August. Sekiya & Co., Ltd., of Nagoya, is founding the proposed $2.8 million Sekiya Aviation Industry Co., Ltd., with the support of the Transportation Ministry. The new firm will purchase five Douglas DC-3 type planes from the Air Carrier Service Corp. of Washington State.

Members of the Council of the Institute of the Aeronautical Sciences voted during their meeting at Los Angeles to accept a $20,000 grant to establish a yearly award for the individual contributing most during the year toward seaplane design. Donor of the grant is anonymous. The yearly award will be $250.

Republic Aviation has received some $15 million in new USAF contracts for spare parts production and modification of F-84Fs. One contract of more than $10 million is for a two-year modernization program for early model F-84Fs to update them to current production models.

Arrowhead Petroleum Corp. has purchased 20% of stock of Meteor Air Transport, Inc., of Teterboro, N. J. Arrowhead President Fletcher Godfrey said the stock purchase will provide Meteor with additional working capital, much of it for new equipment.

Temporary laboratory has been leased by Convair at San Diego to implement company's new basic research program. Dr. Charles L. Critchfield, director of scientific research for Convair, said six of 25 to 30 scientists who ultimately will make up the lab staff already have been hired.

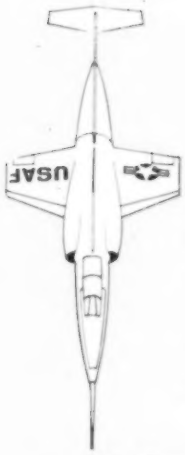
Belgium contracted for a large number of Hawker Hunter fighters for its air force. The aircraft will be built and test flown by Britain's Avions Fairey and Sabca of Haren, near Brussels. Rolls-Royce Avon engines to power the aircraft are being built in Belgium by Fabrique Nationale d'Armes de Guerre.

Multimillion dollar contracts for 50-hp. Mars, 500-hp. Jupiter gas turbines and P&WA J57 jet engine components have been awarded Solar Aircraft Co., San Diego, Calif. The firm set a new delivery record for May, shipping more than $7 million worth of business. As of April 30, the company's sales totaled $51,645,500 with net income after all charges being $1,252,600. Backlog as of April 30: $75,167,600.

National Advisory Committee for Aeronautics plans to fire four two-stage research rockets into the path of hurricanes this summer from Wallops Island, Va. The rockets will be equipped with cameras and air and seaborne location and recovery devices. Floating rocket cones, already tested out by the Navy, will disengage from the rockets at the end of their run and be parachuted into the sea for recovery by destroyers.

Ford Aircraft Engine Division, Chicago, delivered its 1,000th J57 engine to the Air Force. Engine with afterburner is for F-100. Retooling from R-4360 Wasp Major production had to be completed before first J57 was delivered in April, 1954. A. C. Moore, general manager, said second 1,000 J57s would roll out in less than half the time required to produce the first 1,000.

New Bristol 192 helicopter will cruise at 80 kt. and gross 17,200 lb. with two piston engines. Later Napier Gazelle turbine-powered versions will cruise at 120 kt. and gross 18,000 lb. on short ranges. The twin-engine tandem-rotor helicopter will carry 25 passengers and crew of three. RAF has ordered the craft.



THE LOCKHEED F-104A is described by its maker as the world's fastest combat airplane. Such incredible supersonic speed calls for control systems that must be reliable beyond question, under every conceivable condition.

Rigid specifications for the F-104A's prototype, the XF-104, were entrusted to EEMCO, specialist in the design and manufacture of custom-built motors and actuators. Collaborating with the engineering division of Lockheed, EEMCO designed and developed six actuator systems as vital components of the supersonic XF-104.

EEMCO is now manufacturing actuator systems in quantity for the F-104A. EEMCO-designed motors and actuators are on the majority of the latest type military jet aircraft and missiles now being delivered to, or developed for, the U.S. Air Force. They are also being used in industrial applications where high quality and precise performance are vital.

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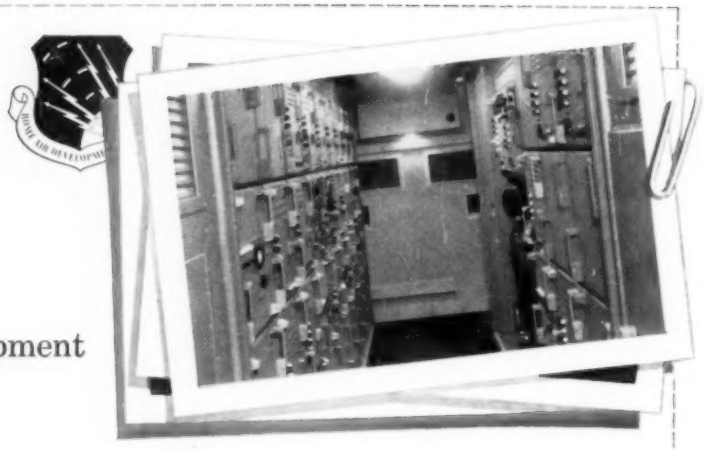
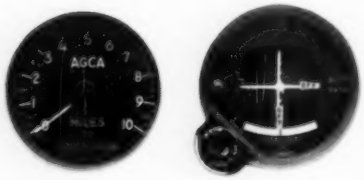
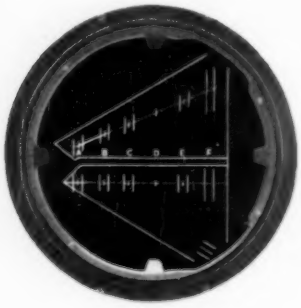


Now undergoing official flight test evaluation at USAF Rome Air Development Center, Rome, N.Y.

GILFILLAN AUTOMATIC GCA



AIRBORNE DISPLAY: Airborne instrument panel continuously displays elevation and azimuth deviation, and distance-from-touchdown data, enabling pilot to monitor automatic approach or to override autopilot for manual approach or to monitor standard GCA talkdown. When aircraft reaches IFR field minimums, a warning light automatically advises pilot.



GROUND DISPLAY: Each of AGCA's six tracking channels, in turn, automatically searches for and locks on successive aircraft and transmits proper control signals for individual automatic approach. Schematic shows aircraft A, B, C and E on automatic approach, aircraft D on GCA talkdown, tracking-channel F on search.

Aviation authorities attending current RADC evaluation tests agree Gilfillan Automatic GCA will demonstrate remarkable efficiency in handling high-density, mixed aircraft rapidly, and with complete protection for all aircraft in the landing pattern.

Favorable comment is being made on AGCA's proved mixed traffic handling capacity to provide (1) Automatic approach, (2) complete position data to pilot for manual approach or (3) standard GCA talkdown–to individual aircraft as required, in the same constant stream of traffic.

Gilfillan AGCA does not obsolete existing equipment, but functions as *an extended automatic use of proven basic GCA and standard airborne telemetering equipment*, relieving the GCA operator of vocal transmission of data, and the pilot of the manual chore of flight path correction. AGCA, with one monitor, takes the place of six GCA operators and several GCA equipments.

AGCA obtains aircraft position from basic GCA *electronically*, transmits flight correction data by *radio impulse* to standard airborne equipment, which activates *autopilot* with correct up/down right/left control for smooth approach to the runway.

AGCA also provides the pilot with range information and complete altitude and azimuth control data on his instrument panel at all times, enabling pilot to monitor automatic approach, or, optionally, to override autopilot for manual approach utilizing 3-dimensional data provided by AGCA, or to monitor standard GCA talkdown.

Pilots flying in RADC tests note that each *individually* controlled aircraft is also protected *as part of the continuous traffic flow*, through the "block signal" system of automatic overtake warning and instant closed-loop indication of any deviation from safe landing limits.

AGCA is the result of ten years of joint research and development by USAF Rome Air Development Center and Gilfillan.

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IATA Airlines Vote to Cut Atlantic Fares

International carriers reach compromise agreement at Cannes; CAB reaction to cuts may be decisive.

By Craig Lewis

Washington—The international airlines voted last week to cut Atlantic fares to end a month-long struggle between high-fare and low-fare partisans at the Cannes traffic conference, sponsored by the International Air Transport Association.

The compromise fare reductions hammered out at Cannes take a gradual approach to the controversial third-class service proposed by the Civil Aeronautics Board and Pan American World Airways.

The new fares now have to be approved by all governments, and the CAB's reaction to the compromise decision will be a decisive factor. The IATA proposals are not what the CAB wanted, but they probably are close enough to convince the Board it should approve.

Proposed Fare Changes

Here is the schedule for North Atlantic fare changes:

• **October 1, 1956:** A new 15-day excursion fare goes into effect based upon a $425 round-trip fare between New York and London. Off-season fares are abolished. The family fare is retained, although it will not apply to the new excursion fare.

• **April 1, 1957:** The 10% increase in first-class fares that went into effect last April is rescinded, and the New York-London fare goes back to $400 one way, $720 round trip. A new deluxe service featuring sleeper seats will be offered at $450 and $810.

• **April 1, 1958:** A third-class service will be inaugurated with New York-London fares of $232 and $417.60 with a one-year validity.

Keith Granville, of British Overseas Airways Corp. and chairman of the conference, said the new agreements "demonstrate the determination of the scheduled airlines to give the public the largest possible quantity of high quality transport at the lowest possible price. They will require the airlines to make extensive changes, not only in their tariffs, but also in their equipment and operating plans."

Granville said the airlines hope the new fares "will make the Atlantic a two-way street by rendering transatlantic flight a practical economic reality for Europeans as well as North Americans."

The IATA airlines also decided to offer a special emigrant fare for westbound travel at 40% less than the normal tourist fare. The fare will be valid between November 1 and March 31 for travel to the U.S. and Canada from all European countries except the United Kingdom, Spain and Italy where other plans exist.

On mid-Atlantic routes, the carriers decided to offer a 15-day excursion fare beginning October 1. The fare is $97 less than a round-trip tourist fare. The carriers agreed to cut first-class fares $30 one way. A $50 charge for sleeper seats also will be introduced.

CAB Policy

The Cannes meeting was an emergency conference called to solve problems raised by the CAB when it limited approval of present fares and insisted that both first-class and tourist fares should be lower (AW May 28, p. 38).

The CAB drew a clear picture of what it thinks the North Atlantic fare structure should be in a detailed policy statement issued in May. The compromise worked out by the airlines is quite wide of the mark set by the Board, but the carriers probably have gone just far enough in their fare reduction program to insure a reluctant CAB approval.

When it reviewed the two cut-rate plans proposed by Trans World Airlines and Pan American World Airways, the Board said TWA's excursion fare offers no solution to the basic problem and said IATA should offer a high density, no-frills, third-class service such as the one proposed by Pan American. The fare, the Board added, should be $400 or less round trip for the New York-London route. This is the route upon which other North Atlantic fares are based on. (See p. 38 for the airlines' reactions.)

IATA's answer to the October 1 deadline, when CAB approval of present fares expires, is an excursion fare $75 higher than TWA's $350 New York-London proposal. The excursion fare will replace the former practice of lower fares during the off-season.

The Board said that the 10% increase in first-class fares which went into effect April 1 over CAB objections should be rescinded October 1. The airlines decided to let the increase ride through the winter and then rescind it April 1, 1957.

The extra charge for sleeper seats favored by the CAB is partially covered by the extra-fare deluxe service to start in April. IATA carriers will charge an extra $50 instead of the $75 suggested by the Board.

The third-class service, which was the core of the CAB's proposals, is scheduled for April 1, 1958, instead of April 1, 1957, as suggested by the Board. The $417.60 fare is slightly more than the $391.50 proposed by PanAm and approved by the CAB.

When they decided the third-class fare should become effective in the spring of 1958, the IATA airlines put off deciding definite terms and conditions for the new service until the IATA conference scheduled for the fall of 1957. At that meeting the airlines also will decide what other classes of service they will offer, and what the relationships between them will be.

Effect of World Prices

Granville said it is necessary to allow for some adjustment in the proposed third-class fare level at the 1957 meeting because it is impossible to forecast the effect of world prices on airline costs 18 months ahead. But he said the new fare would remain 20% less than the next higher fare.

Most of the action taken at the Cannes meeting was on Atlantic fares, and the fare pattern in other areas remains largely the same. The carriers agreed with the CAB that polar fares between Europe and Tokyo should be the same as the fares charged for travel between the points via India.

Polar fares between the West Coast and Europe will be the same as the fares via New York, and the deluxe and normal first-class services voted for Atlantic will apply to these routes.

First-class fares on North Pacific and mid-Pacific routes will be cut by $10 between North America and Tokyo and $25 to other Asiatic points. No cut was made in tourist fares, but the carriers agreed to meet next spring to discuss a Pacific excursion fare.

The European fare pattern will be adjusted slightly upward, as will fares from Europe to the Middle East, the Far East and Africa, and fares between African points.

Cargo rate levels have been adjusted to promote development of new types of cargo traffic on many routes by low rates for specific commodities.

Some Airlines Show Enthusiasm, Others Are Dubious of Fare Cuts

By Glenn Garrison

New York—Consensus of the foreign-flag transatlantic carriers is that the fare agreement reached at Cannes by the International Air Transport Association represents as satisfactory a compromise as they could expect. But plenty of private doubts remain.

Perhaps the key point in the fare agreement is its timing. Deferment of the third-class service until 1958 goes a long way to solve the problem of finding equipment to handle the expected volume of low-fare travelers.

Most of the carriers have long-range equipment on order that will be available by spring 1958. The breathing spell also allows time to modify equipment to high density configurations for the third-class flights.

The time extension therefore partially relieves a major concern of many of the airlines, as expressed before the Cannes conference (AW May 14, p. 39). Also, the fact that the 15-day excursion fare goes into effect this fall is an advantage equipment-wise. More will be available because of the off season.

Those carriers with anything to say in public about the new fares are radiating cheer. British Overseas Airways Corp. "welcomes the introduction of these new low Atlantic fares and excursion tickets," calls the action "important" and expresses "enthusiasm" for the plans.

Air France is "perfectly happy with the new arrangement" and considers it a forward step.

Scandinavian Airlines System, referring specifically to the 15-day excursion fare, believes it will tap new markets and offer many salaried workers their first opportunity to travel abroad.

Many airlines, though, are keeping their ideas to themselves while they digest the economic implications.

Of the American lines, Trans World Airlines is happy about the outcome of the conference, expressing "100% agreement" with the voting. Pan American has "no comment" on the results.

Deep reservations remain, however, on the part of some foreign-flag carriers who went along with the compromise agreement. Among the points of uncertainty.

• **Will the smaller carriers** be able to survive a possible equipment war when the mass third-class traffic begins? If the small carriers can't afford enough aircraft to make up in volume what they will lose in per-passenger revenues, they may be faced with the alternatives of going out of business or seeking heavy support from governments wishing to maintain the prestige of a flag line over the Atlantic.

• **Will passengers accept** the high density, no-frill service planned for the third-class traffic? Some carriers feel the passengers may be so cramped and uncomfortable by the time they've flown the Atlantic that their reaction will be antagonistic.

• **Will market materialize** to the expected degree? This is far from a certainty, say some sources who feel that general economic conditions might make it impossible to fill the greatly increased fleets even in the summer.

In other words, some carriers who voted for what they felt was an inevitable compromise retain some of the same misgivings they had before the IATA conference began.

One point of concern expressed before the conference was the adequacy of tourist accommodations on both sides of the Atlantic to handle an influx of low-budget travelers. Now the feeling seems to be that it's out of airline hands and up to the tourist agencies of the various countries concerned.

Still very much in the carriers' mind is resentment against the Civil Aeronautics Board for its pre-conference statements favoring the third-class plan.

Airlines Call Lease Plan 'Huge Success'

Washington—Slick Airways and Flying Tiger Lines last week termed their DC-6A lease contract with the Navy a huge success. The two lines would like to see the program extended, and both have high hopes of getting more equipment through the Air Force under similar contract terms.

The decision by the two cargo lines to spur the Air Force to follow the Navy's program stems from the high load factors and excellent utilization achieved with the aircraft leased from the Navy in August 1955.

During the first nine months these results have been obtained:

• **Flying Tiger** has reported a monthly load factor ranging from a low of 72.5% in September 1955 to a high of 79.8% in April 1956.

• **Utilization ran** from a high of 12.11 hours in March 1956 to a low of 8.02 hours in August 1955. Average utilization totaled 10.93 hours.

• **Monthly load factors** on the Slick aircraft show a low of 62% in April 1956 and a high of 82% in August 1955.

• **Slick's utilization** reached a high of 10.40 hours in August 1955 and a low of 7.05 hours in February 1956 for an average of 9.03 hours.

The Navy program was created last year by the Air Coordinating Committee. Under the contract, each company leased from the Navy one R6D, military version of the DC-6, on an annual basis with a renewal provision. Rental of each airplane is $252,000 yearly.

Operation is restricted to commercial service and may not be diverted to military contract or charter work. Each carrier also is required to place an order for a civilian DC-6A or an aircraft of equivalent capacity each time the contract is renewed. The Navy may recall its planes at any time.

The Air Force contract presumably would be drawn up along similar lines. In its projected program, the Air Force is considering renting of two DC-6As and three DC-4s.

At least one large domestic carrier has been highly critical of the Navy program. It contended that the cargo field was not sufficiently developed to justify the additional equipment and that the plan represented "government intrusion into the domain of private industry." The airline also charged that growth of the lease plan might discourage investment of private capital.

The Navy is satisfied with the results of its lease program. Navy says it can meet its peacetime requirements with fewer aircraft and that lease of the excess planes will foster development of the air cargo potential, insuring a more efficient traffic flow in times of emergency.

Navy backs this belief with traffic figures showing a 20% increase in cargo traffic by scheduled airlines from 1954 to 1955, compared to a 42% increase by "non-mail" carriers for the same period. One Slick official admitted that his company might have faced serious financial trouble had it not been for the relief provided by the Navy DC-6A.

Navy also contended that the program would stimulate the purchase of additional equipment by private industry. This has been borne out by Flying Tiger's order for 10 Super Constellation 1049Hs for delivery in 1957. Slick purchased 3 DC-6As last year and this year placed an order for an additional five.

In another program, the Navy thus far has leased to air carriers 23 DC-3s, 18 of which have gone to local service airlines. Two Navy DC-4s have been leased, one to Trans-Ocean Air Lines and one to Meteor Airline. Under this plan, there are no restrictions as to the areas in which the planes may be operated and the leases don't have the purchase order provision contained in the Flying Tiger and Slick contracts.

East Coast Case Will Define CAB Policy

Washington—The New York-Florida case, now moving into its final phase, will give the Civil Aeronautics Board and its two new members their first chance to show whether they intend to follow the new philosophy of airline competition defined by the CAB last fall.

Briefs have been filed in the hotly contested case, and the Board will hear oral arguments next week. At issue is the pattern of competition on East Coast airline routes.

The CAB's decision in the New York-Florida Case is important not only because it will define a new airline pattern on eastern routes, but also because it will show whether or not the Board intends to continue to follow the competitive philosophy it established in a series of major cases last year.

In 1955, the CAB undertook a major rewrite of the airline route pattern. In three cases—New York-Chicago, Denver Service and Southwest-Northeast—the Board increased competition among trunk airlines substantially and expanded the systems of some of the smaller carriers to a considerable degree.

Change in Pattern

When it changed the pattern of competition, the Board said its purpose was to strengthen the positions of the smaller trunk airlines and cut down the size gap between these lines and the Big Four—American Airlines, Eastern Air Lines, Trans World Airlines and United Air Lines. The CAB took the view that stronger regional trunklines would be able to compete more effectively with the larger carriers.

In some disputed cases, it was a three-man majority which carried this competitive philosophy through the three cases that represented the first major revision of trunk routes in several years.

Now two members of the old majority—Ross Rizley and Josh Lee—have left the Board and James R. Durfee and G. Joseph Minetti have been appointed to replace them. The New York-Florida Case will give the new Board its first major opportunity to demonstrate just which way it leans on the important question of competition among airlines.

The battle over the East Coast routes involved in the New York-Florida Case has been fought vigorously by the major contestants. Eastern and National Airlines have struggled to keep the long haul rates between the northeast and Florida for themselves. Nine other airlines have fought just as hard to get into the prosperous eastern markets involved in the case.

A part of the battle has moved out of the halls of the CAB and into the communities involved. There has been considerable effort among the airlines to bring to bear the influence of cities and states that lie along the eastern seaboard.

Community Pressures

The New England area has put most of its support behind Northeast Airlines' efforts to expand its system to the south.

Northeast has had support from the states it serves and from the congressional delegations from the New England area.

Pan American World Airways' attempts to obtain a domestic route have been supported by the cities of New York and Baltimore. New York thinks Pan American can start new service faster than any other airline, and Baltimore likes Pan American because the carrier has "expressed its intention and desire to use Friendship Airport to serve the Baltimore-Washington area."

In a letter to Maryland Sen. Marshall Butler, a leader in the fight to improve service to Baltimore, National's Vice President Alexander G. Hardy said Pan American's pressure to use Baltimore influence is in exceptionally bad taste.

Hardy said Pan American "has been hoodwinking Baltimore for years" and its interest in the city is a "last-minute grandstand play."

So far, Delta Air Lines is in the best position in the case. CAB examiner Thomas L. Wrenn has advised the Board that Delta should be the third carrier on the New York-Florida route.

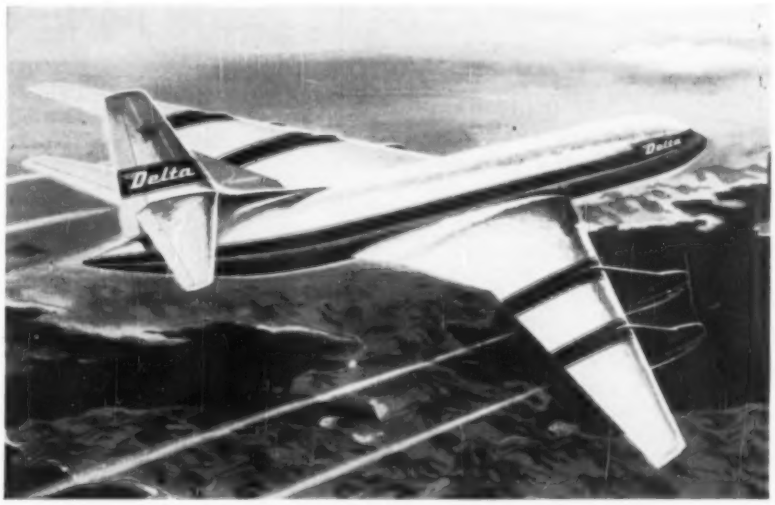
In support of the examiner's conclusion, Delta's brief said the airline would offer the greatest amount of service along the East Coast with a minimum change in its routes. Delta argues that it already is established in most of the cities on the New York-Florida route, and that a policy of rounding out the pattern of an airline already in the area, rather than bringing in a new airline, is the soundest approach to the situation.

Delta also argues that it would pose a less serious threat to National and Eastern than other carriers. The effect of a third carrier on National was a major consideration in the examiner's report.

Opposing the certification of Pan American on the route, Delta said it would break down the National (Pan American) Panagra interchange to South America and bracket National between Eastern and Pan American, two of the nation's largest carriers. Delta concludes that this probably would put National back on subsidy.

Pan American's Stand

Pan American told the CAB the highly seasonal New York-Florida market fits the PAA pattern best since its traffic peaks are in the summer season. The airline said it could offer 15 round trips a day between the north-



Delta Golden Arrow

Convair Golden Arrow medium-range four-jet airliner wears Delta Air Lines marking in rendering above. Delta has ordered 10, Trans World Airlines 30 of the CJ-805-powered planes. Golden Arrow would be used by Delta on New York-Florida run if CAB approves route.

east and Miami next winter, many of them with DC-7C equipment freed from Atlantic service by slack winter traffic.

Pan American said it would have the advantage of offering single carrier service to international points, a service that is lacking at most eastern points. The airline is particularly interested in having a direct link between New York and its extensive Latin American system and says an interchange is not the proper solution.

Replying to arguments that certification of Pan American would damage National, Pan American said the argument is based on an appeal for sympathy and favors the private interest of an airline over the public interest. The airline said in its brief that National has grown to where it can stand the competition and estimated that Delta would divert more revenue from National than would PanAm.

Support for Northeast

Northeast Airlines has had the support of the CAB's Bureau Counsel in the case, but the examiner's report ran strongly against the choice of Northeast for the route. Examiner Wrenn questioned the airline's ability to compete effectively with Eastern and National and suggested that the CAB look into the relationship between Northeast and the Atlas Corp. which controls it.

Northeast said the CAB has approved all transactions and relationships with Atlas, and there is no basis for censure. Northeast also argues that it is a better choice than Delta for the route because its seasonal pattern better fits the needs of the route.

The New England airline contended that it is the carrier in the case most urgently in need of strengthening, and the only applicant utterly dependent upon certification in the New York-Florida Case for such strengthening. Northeast also argues that it would offer more new single carrier service than Delta.

Northeast told the Board that it offers the prospect of important subsidy elimination if it gets the route, while it will probably require permanent subsidy if it fails to get it.

Capital Airlines offered the seasonality argument in its bid for the route, and said that it would be able to offer more new single-carrier service to Florida points than any other carrier in the case.

Capital told the CAB it needs access to the long-haul northeast-Florida markets in order to improve its marginal position in the industry. The airline said the new routes it received in the New York-Chicago and Southwest-Northeast Cases have failed to cure all of its difficulties.

Countering questions concerning the ability of Capital's Viscounts to compete with DC-7s, the airline said no one has seriously contended that it could not operate profitably with the turboprop transports. The carrier said the Viscount would be a superior competitor in the markets Capital has asked for and that it plans to buy newer, more modern equipment when it becomes available.

Capital reportedly has reached a break-even load factor of 57% with its Viscounts and plans to eventually reduce the breakeven point to 53-55%. Direct costs on the Viscount are reported to be about five cents a mile below the original estimates of 83 cents.

Both Eastern and National continue to dispute the positions of the examiner and the other airlines who say there is room for another carrier on the East Coast route. The two carriers insist that the route is currently receiving the best of service and will continue to be well served as their orders for new equipment are filled.

Opposition by National

National pointed out that Delta estimated it would divert $8 million from National if it got the route. National said this diversion would force it back on subsidy, largely because it relies on New York-Florida traffic for the major part of its revenues and profits.

The airline said certification of Pan American would be even more damaging. National said such certification would result in a battle of the giants—Pan American and Eastern—with the smaller carriers—National and Braniff—"trampled underfoot."

National then contended that the only sound solution to Northeast's problem is combination with another carrier. National repeated an offer to buy Northeast and take over its route system.

National said its biggest problem is to find ways of overcoming "the effect of the incessant propaganda and political pressure which has been engendered by the ceaseless efforts of numerous applicants who have lured many civil organizations to their support by promises of improved service." It added:

"We only ask the Board to consider the facts of record and give serious consideration to the effect of a triplication of National's route in the event everything does not turn out to be 'just peachy' in this industry."

Eastern points out that Riddle Airlines has been certificated to carry cargo on the East Coast route and numerous supplemental air carriers can offer a limited scheduled service in competition with Eastern and National under terms of authority granted last winter.

Eastern said its "pioneer system has been so denuded of traffic support through the imposition of competitive grants throughout its entire length and breadth, the only 'cushion' which Eastern would have left if the examiner's recommendations were adopted would be the bare bones of a once-sound air transportation system."

Examiner's Report

Among the various shorter routes along the East Coast that are involved in the case, the Washington-New York-Boston segment is the most popular. The examiner recommended that National be allowed to operate a turnaround service between the cities. He also favored Capital for a Norfolk-Washington-Baltimore-Philadelphia-Newark-New York route to put the carrier in the market, and the New York-Florida route recommended for Delta would allow that carrier full participation in the Washington-New York market.

The examiner also recommended that Eastern's New England restriction be lifted so that the airline can operate local service between Boston and New York. He also advised the CAB to close the gaps in the eastern ends of the route patterns of United and TWA. This would allow the two carriers to operate between the major eastern cities with long haul restrictions.

National, Capital, Delta, TWA, United and Eastern are all in favor of the new services proposed for them in the Washington-New York-Boston market, but TWA and United want authority to operate local service in the area.

American and Eastern object to more competition on the Boston-New York-Washington route. American says the service is already plentiful and that traffic conditions in the New York area will not permit a new carrier to add a significant number of flights.

Berta: South America Needs Easier Credit

American aircraft manufacturers will face increasing competition in South America from European producers unless they ease their credit terms, the president of Varig Airlines of Brazil warned at a recent New York meeting of the Export Committee of the Aircraft Industries Association.

Ruben M. Berta told the AIA members South American airline operators have been able to buy only half the modern equipment they need by mustering all their cash and credit resources. While the South Americans prefer to stay with American equipment, Berta said, the U. S. manufacturers and credit institutions would "move themselves into more favorable positions" if they would adapt their contracts and sales proposals to South America's problems.

PORTABLE conveyor belts, one for each door of DC-6A, play a big part in two-hour turn-around loading and unloading operation.

Quick Turn-Around Pays Off Cargo Line

Through efficiency of operation and high personnel enthusiasm, Flying Tiger Lines has cut turn-around times for its cross-country cargo flights to the bone. And in at least one instance, this super-efficiency is paying off in an additional flight with no addition of equipment.

For example, a former westbound flight out of Newark at 10:30 p.m. arrived at Burbank, Calif., at 7:30 a.m. It didn't get out until 10:30 that night. Now the same flight arrives at 6:30 a.m. and leaves again the same morning at 8:30. It gets back to Newark at 7:30 p.m. and departs again at 10:30.

Some corners are cut—like the elimination of a westbound stop at Detroit and the sacrificing of 7,000 lbs. of payload to avoid an eastbound gas stop—but the real key to that speedup was the cutting down of layover time.

Frank Lynott, FTL vice president-operations, estimates that Flying Tiger ground personnel are unloading, loading and servicing flights in about two hours during the five-day week all schedules are operative. Longest ground time at any point is three hours, fifteen minutes. Before the airline began trying out the new schedules last month, four hours was considered the minimum time for taking 30,000 pounds off a DC-6A, putting another 30,000 pounds aboard.

Utilization of each of the line's three DC-6A's is averaging about 15 hours daily, according to Lynott. Ground handling of cargo is speeded by use of two conveyors, one for each door of an aircraft. Emphasis is placed on getting the unloaded cargo delivered by truck with a minimum of delay, and Flying Tiger is considering installing radios in its own leased trucks to expedite this.

To keep tab on the elapsed time from airport to consignee, Flying Tiger now IBM's the information from delivery receipts.

To avoid maintenance delays, FTL pilots radio two hours or so from destination to advise of any mechanical problems. Mechanics meet the plane prepared for quick repair and maintenance. To illustrate personnel enthusiasm Lynott told how crew members saved seconds by opening cargo doors while the aircraft was still rolling. But Douglas Aircraft advised against the practice and it had to be discontinued.

Under its recently granted authority, Flying Tiger is earning revenues at a rate of about $15,000 a month for mail and $33,000 a month for express items according to President Robert Prescott.

By making the most efficient use of its DC-6A's, Flying Tiger has reduced its use of the less economic C-46. The ratio has changed from 60-40 in favor of the C-46's to 50-50, and the goal is an 80-20 ratio in favor of the Douglas equipment. Tiger operates the C-46 for about 14-15 cents a ton-mile compared with 6-7 cents for the DC-6A.

Prescott said he had consulted with Boeing about possible cargo use of the 707, and that an operating cost figure of 3¼-4 cents a ton-mile had been discussed, with a 70-75,000 payload over an 800-mile run.

The Lockheed Electra also would make a good cargo airplane, Prescott said, if the company were interested in adapting it for that use.

United Starts DC-6A Cargo Service

Los Angeles—Additional fast transcontinental all-cargo service was offered the nation's shippers and distributors recently when United Air Lines put two DC-6A cargoliners into service.

United's all-cargo flights follow a similar service introduced by American Airlines which now has in operation seven DC-6A and six DC-4 all-cargo ships.

United has scheduled the two new cargoliners for departures five nights a week from both the West and East Coasts. Schedules will be increased near the end of July when the airline takes delivery of three more all-cargo DC-6As.

With a complement of five cargoliners added to a fleet of eight all-cargo DC-4As and 175 combination passenger-cargo planes, United predicts a 70% boost in its cargo business.

Features of the cargo liners include:

• **Cargo cabin** 68 ft. long with 4,433 cu. ft. of space. Lower aft and forward compartments provide an additional 567 cu. ft. Two oversize cabin doors facilitate on-and-off leading.

• **Doors** 6½ ft. high and 10¼ ft. wide.

• **Fiberglas-lined** cabin and lower aft and forward cargo compartments. Cabin deck is constructed of corrugated sheet metal with a covering of aluminum alloy. It supports loads of 200 lb. per sq. ft.

• **Air conditioning system** which can maintain flight temperatures of from 40 deg. to 72 deg. Separate controls are provided for variation in the cargo cabin and cockpit temperatures.

United featured "Cargorama-1956" day here when introducing the new service. After inspecting the interior of one of the cargoliners, visitors witnessed a freight handling demonstration, watching special tools, designed for fast on-and-off loading, move bulky items.

The airline believes its method of centralized cargo control and its reserved air freight program brings the passenger reservation concept into air freight.

Eastern Reorganizes Sales for Expansion

Eastern Air Lines has set up eight sales divisions in a move to decentralize field management for its $400 million expansion program. Under the new organization, Eastern's territory is divided into Atlantic, Colonial, Southern, Florida, Midwest, New England, Gulf Coast and Latin-American divisions.

The airline has discarded title of traffic and sales manager and replaced it with the titles of district sales manager in heavily populated areas and city manager in its smaller stations.

The various promotions and transfers announced by Eastern include the following:

M. B. Westphal from traffic and sales manager, Miami, to Atlantic Division sales manager.

James Reinke, former Colonial Airlines traffic and sales manager, to Colonial Division sales manager.

Edwin Williams from traffic and sales manager, Birmingham, to Florida Division sales manager.

Marvin O. Byrd from Traffic and sales manager, Chicago, to Mid-Western Division sales manager.

Daniel Sinkler from traffic and sales manager, Atlanta, to Southern Division sales manager.

Al Tirrell from traffic and sales manager, New England territory, to New England Division sales manager.

Walton Cutshall from traffic and sales manager, New Orleans, to Gulf Coast Division sales manager.

Herbert Dobbs continues to head the Latin-American Division as sales manager.

CAB ORDERS

(June 14-20)

GRANTED:

Caribbean Air Transport Assn. and Pan American World Airways authority to engage in discussions designed to stabilize air cargo rates between Florida and Central American points and between New Orleans and Central American points. Discussions are authorized for a period of thirty days beginning today.

Flying Tiger Line an exemption to operate three round-trip charter flights for the Association for World Travel Exchange, Inc.—International Camp Counselor Exchange Program. The Board reconsidered its earlier denial of the application.

Ozark Air Lines permission to serve Burlington, Ottumwa and Des Moines, Iowa, through their respective municipal airports.

American Air Export and Import Co. authority to use the name Atlantic Airlines in its operations.

Regina Cargo Airlines an exemption to perform nine charter flights from points in the U. S. to points in Canada, three for the Richmond Baseball Club and six for the Miami Baseball Co.

Seaboard and Western Airlines an exemption to perform a charter flight from New York to London pursuant to a contract with SITA World Travel, Inc.

Minneapolis-St. Paul Metropolitan Airports Commission and the State of Wisconsin permission to intervene in the Duluth-Chicago Service Investigation.

Permission to intervene in the Seven States Area Investigation to the City of Quincy, Ill., and the Quincy Chamber of Commerce; the City of Kansas City, Mo.; Lawrence County, S. D.; the City of Deadwood, S. D., and the Deadwood Chamber of Commerce; the City of Lead, S. D., and the Lead Chamber of Commerce; the City of Spearfish, S. D., and the Spearfish Chamber of Commerce.

Trans Caribbean Airways an exemption to operate four flights from New York to Prestwick for British Overseas Airways Corp. and three flights from Hamburg to New York for the Intergovernmental Committee for European Migration. Consideration of other flights planned by TCA was deferred.

Flying Tiger Line an exemption to operate transatlantic charter flights for Europe Cooperative; Kollsman Instrument Travel Club, Pratt and Whitney Aircraft Club, Inc., Czechoslovak Sokol Abroad and Rattviks Spelmanslag. Seaboard and Western Airlines was granted an exemption to operate transatlantic charter flights for Flushing Manner Und Damen Chor and German-American Societies of Westchester Counties.

APPROVED:

Interlocking relationships between V. O. Coggins, American Flyers Airline Corp. and American Flyers, Inc. The Board found that American Flyers has the authority to engage in air taxi operations.

Agreements involving Allegheny Airlines, Mohawk Airlines and various other carriers relating to intercarrier arrangements.

ORDERED:

Laurentian Air Service Ltd.'s authority to operate service of a casual, occasional or infrequent nature between Ottawa, Ontario, Canada, and all points in the U. S. bounded by latitude 48 degrees north and 36 degrees north, and longitude 96 degrees west and 67 degrees west extended for three years.

New York Airways' temporary mail rate set at the rate proposed by the Board in its show cause order for the period beginning Feb. 3.

Ozark Air Lines certificate issued in the Fort Dodge-Peoria Case canceled and an amended certificate issued in which Ozark is authorized to operate between Peoria and Des Moines via Burlington and Ottumwa, with permission to skip-stop intermediate points. Ozark must serve each point on the route with at least two round trips a day. On flights serving Des Moines and Chicago, the airline must stop at a minimum of two intermediate points, one of them Peoria.

Braniff Airways certificates for Routes Nine and 48 amended to reflect suspension of service at Ottumwa and Burlington, Iowa, while Ozark Air Lines serves the two points.

Parties interested in the Northwest Airlines, Pittsburgh-Cleveland and Detroit Restriction Case and the deferred portion of the New York-Chicago Service Case to submit briefs to the Board on the question of whether Northwest or Eastern should be chosen to operate unrestricted service between Pittsburgh, Cleveland and Detroit if the Board decides only one carrier is needed.

DISMISSED:

Western Air Lines complaint requesting suspension and investigation of a coach-fare proposal filed by Southwest Airways.

Investigation of round-trip excursion fares and automobile rental charges proposed by United Air Lines since the fares have expired.

Investigation of increased local first-class fares filed by Braniff Airways since the fares have been canceled.

DENIED:

Flying Tiger Line's application for an exemption to fly 43 World University Students to Europe on a split charter with 27 of them flying with an Eddy Seminary charter party and 16 flying with a Harvard-Radcliffe Co-op charter party.

Petitions for reconsideration filed by Eastern Air Lines and the City and Chamber of Commerce of Albany, Ga., in the Panama City-Atlanta Service Case.

Shortlines

► **Flying Tiger Line** signed a freight interchange agreement with the American President Line which the airline says will be "the basis and the initial start of eventual joint sea-air rates."

► **Middle East Airlines** now operates twice-weekly Viscount service to Beirut, Lebanon, by way of Paris, London, Zurich, Vienna and Athens, and three flights a week from Rome. The Airline also serves Syria, Iraq, Iran, Turkey, Egypt, Arabia, the Persian Gulf, Cyprus and Jerusalem.

► **Swissair** plans to start service to Argentina by the end of the year with a weekly DC-7C flight from Geneva via Lisbon, Dakar, Recife, Rio de Janeiro and Sao Paulo. Canadian Pacific Airlines started a weekly service to Buenos Aires in June, and Lufthansa plans to inaugurate service in August.

► **Trans-Pacific Airlines** says it hopes to replace its DC-3 fleet and thinks the Handley-Page Herald and the Fokker F-27 are the most likely successors. According to TPA President Ruddy F. Tongg, financing of a replacement depends on the airline's ability to make down payments of about $300,000 from cash reserves.

► **United Air Lines** flew 378,441,000 passenger miles in May, a gain of 13%

over the previous May. In the same period, mail was up 15% to 2,414,000 ton-miles, freight up 13% to 3,995,000 ton-miles and express up 2% to 971,000 ton-miles.

► **VARIG Airlines** of Brazil will add a third round trip between New York and South America on July 3.

► **Braniff Airways** chose Aeroproducts propellers for its Allison 501-powered fleet of nine Lockheed Electra transports.

► **Braniff Airways** has put into service the first of nine DC-6s being modernized under a $1.2 million program. Cabin interiors are being redesigned and Pratt & Whitney R2800-CB-16 engines installed. Modifications increase cruising speed from 300 mph. to 325 mph. and gross takeoff weight to 95,200 lb.

► **Trans World Airlines** has signed an interline agreement with TACA International Airlines designed to cut 24 hours off schedules between Central America and Europe. . . . TWA will furnish pilots to Lufthansa for another year.

► **CINTA, the Chilean airline,** has purchased two DC-3s from the Air Corp. of Miami for use on its route from Santiago to Potrerillos and Chuquicamata to serve Anaconda Corp.'s copper mining operations in the Andes.

► **Cuba and the U.S.** have signed a technical cooperation agreement to aid the Cuban Civil Aeronautics Commission in improving its traffic control system. The agreement stipulates that the U.S. will furnish experts in flight control, electronic engineering and flight operations.

► **Guinea Airways Ltd.** of Australia carried 92,635 passengers in the year ending February, 1956, as compared with 87,244 for the previous year. Air cargo traffic rose from 2,688,619 lb. to 2,741,379 lb. in the same period.

► **Lake Central Airlines** boarded 13,277 passengers in May, a 28% increase over May, 1955. Load factor in May was 44.47%, as compared with 38.7% for the previous May. Lake Central flew 7,891,933 passenger-miles in the first five months of the year.

► **Tasman Empire Airways** plans to operate at least 100 extra flights between New Zealand and Australia to handle travelers to the Olympic Games. The airline also plans to introduce a new route between Auckland and Melbourne.

COCKPIT VIEWPOINT

By Capt. R. C. Robson

To Cut or Not to Cut

Every so often the question is raised as to the advisability of cutting engines on pilot training flights. Interest in this subject rises after an accident or two—a natural reaction. The recent crash of a Viscount, and a previous crash of a DC-6 has brought on the present discussion.

Specifically, the question revolves around the value that pilots receive from making sudden-power-loss take-offs vs. the risk of such maneuvers. Many competent pilots believe the danger is great enough to warrant elimination of this type of practice. Others, equally well qualified, believe such training is necessary.

It is safe to assume that nobody wants accidents—on training flights or otherwise. Pilots rarely attempt aerial suicide deliberately or do operators relish the idea of wrecking million-dollar aircraft, and losing valuable employes.

As far as I know there are no safe-mile statistics, or percentages, available on pure training operations as there are elsewhere in aviation. On the other hand they might not prove much anyway. We already know that training is dangerous. And this applies to auto driving, swimming lessons or what have you.

We simply have to start to learn how sometime.

Blame Is Shared

Proficiency flight accidents are not caused solely—or even mostly—by cutting engines on take-off. They are caused by a hodge-podge of more reasons than we know. It is a simple fact that anytime we go out to "kick it around a little," to see what the airplane or the pilot can do, the door to trouble is unlocked. But the point to remember is that if we eliminate flight training that trouble door is opened wide.

There is one argument more compelling than all others combined in favor of continuing partial power practice near the ground. That is, "Is it right, morally if not legally, to permit a pilot to become captain of a craft and entrusted with the lives of passengers if he has never had this experience?" Obviously no diploma can guarantee against such an actual happening.

There are those who will say, "Do it in a simulator." Naturally it should be tried there first. But does a simulator really provide an adequate substitute?

Can all the conditions of flight, rough runway, cross-wind, temperature, turbulence, etc., be properly simulated? Granting even an affirmative answer to this, can make believe compensate for the knowledge that you are really in a fast moving, multi-ton aircraft close to the ground? If nothing else there are human variables, beyond the ken of a simulator, which cannot be duplicated in a stationary device.

Realistic Training

It would appear that overall safety requires realistic flight training as well as simulator practice. Perhaps by means of more pre-flight planning, fewer tricks and high pressure check rides and less haste these episodes can be made safer.

I do not enjoy danger in the air. But wouldn't it be more dangerous to turn out pilots who have never known, or successfully coped with, low altitude engine failure.

I must also confess that if I were a check pilot I might not agree with this philosophy. The trainee might have to stick his neck out twice a year or so; mine would be out on every ride. On the other hand that's what check pilots are for and there is nothing like actual, unadulterated flight training to produce competent pilots.

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The driving walls of this highly effective recess (see drawing at left) form a direct axis for driving. This exclusive recess design makes possible power driving at extremely high torque, yet TORQ-SET *can be removed without difficulty.* What's more, TORQ-SET is supplied in highly-alloyed steels and the recess design permits extremely high driving force without burring or distortion.

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SATELLITE simulation is job of hypersonic wind tunnel.

RE-ENTRY under unstable conditions is duplicated in tunnel.

Gas Dynamics, Part II:

Hypersonic Quest Yields New Techniques

By David A. Anderton

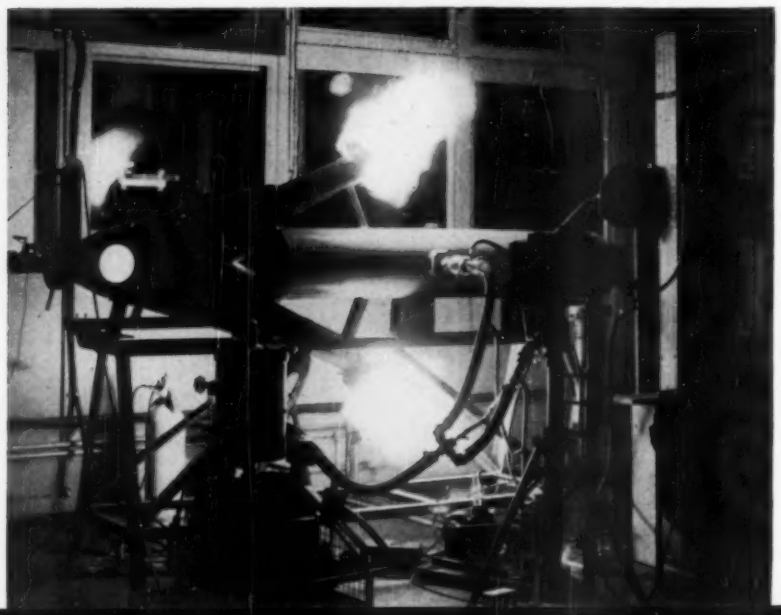
New families of test facilities to simulate the unusually rigorous and different requirements of hypersonic and superaerodynamic flight are a major development area in the growing science of gas dynamics.

The time-tested tools of the supersonic trade—wind tunnels, free-flight ranges, aerodynamic test vehicles—have been adapted and extrapolated to higher speed ranges.

But their inherent limitations have forced an inventive approach to unconventional techniques that use the temperature of an electric arc, the potential energy of a compressed light gas or the bursting strength of an electromagnet to simulate the velocities of intercontinental ballistic missile flight.

Simulation of the unique flight paths of an intercontinental ballistic missile or the earth satellite is a matter of getting and maintaining the proper flow conditions and patterns around the vehicle. There is no difference whether the model moves through still air, or the air moves past the stationary vehicle.

CORNELL HYPERSONIC TUNNEL at 9,000 mph. is photographed by its own light.



Both approaches have become standard techniques in aircraft and missile development. The wind tunnel, with its varied modifications for free-jet, blowdown, molecular beam or shock-driven operation, remains the fundamental type of air mover facility. Free-flight vehicles, ballistic models fired down instrumented ranges and track test sleds are current examples of the mass mover facility.

The choice of test apparatus is dictated by many factors. One of the primary considerations is the type of parameters desired. Generally a wind tunnel provides static or steady-state data; the model is tested under equilibrium conditions and the data obtained includes lift, drag, pitching moment and similar values. The moving mass test apparatus generally gives dynamic data such as the transients during starting and stopping and the qualitative and quantitative measures for assessing dynamic stability.

Both kinds of facilities have fringe areas. Wind tunnels can be and are used to provide much transient and dynamic data; moving mass testers produce large quantities of steady-state parameters. But their general values are as outlined.

These are some of the problem and

NACA'S AMES LAB light gas gun fires small projectiles at speeds to 10,000 mph. for simulation of satellite and missile re-entry.

progress areas in the simulation of unique flight problems.

Wind Tunnels

Certainly the wind tunnel is the most valuable test tool of the aerodynamicist. During its years of development it has continually been improved, its speed and altitude capabilities extended, its instrumentation and data recording automated, keeping pace with advances in the aeronautical art.

Tremendous advances in instrumentation and data-gathering techniques have made it possible for wind tunnels to produce more and more data points in less and less time. Automatic readout, reduction and data plotting computers have been able to produce continuous plots of aerodynamic data while the model is completing its test runs.

But the quality of the test results depends on the quality of the air inside the tunnel, and that's the catch. A supersonic tunnel reaches proper test velocities by expanding compressed air through a supersonic nozzle upstream of the test section. Expansion cools any gas, and the greater the pressure drop, the greater the cooling.

For Mach numbers approaching four, the temperature drop of the expanding air is enough to condense out moisture in the air, giving a fog in the test section and changing the test results. To beat this, wind tunnel scientists added driers to remove the moisture from the ambient air. This increased the Mach number range available.

At higher values the temperature drops low enough to condense the air itself in the test section. The only way to avoid this is to heat the air upstream of the test section so that the temperature drop will not go low enough to give condensation.

For hypersonic speeds, the heating and drying requirements become enormous, comparable in magnitude to the power required to drive the tunnel. The heated air should be at temperatures of several thousand degrees Fahrenheit to eliminate liquefaction completely, and this sort of temperature could melt down a tunnel reservoir.

Helium Tunnel

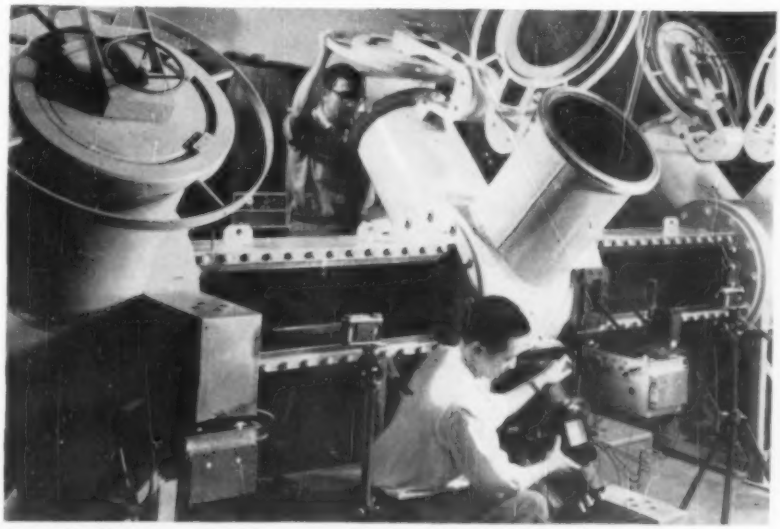
One way to avoid liquefaction is to use a gas that doesn't liquefy at the test section temperatures. Helium is one, and it has been used successfully in a hypersonic, intermittent tunnel at Princeton University.

Test section velocities up to Mach 20 have been reached in the tunnel.

Actually tests in a helium tunnel do not simulate the flight problems accurately.

The greatest value of these tests is in their contribution to the understanding of the fluid dynamics problems.

The Princeton tunnel is a blowdown type. High-pressure helium upstream expands through a supersonic nozzle and into a reduced-pressure area provided by a downstream air-driven ejector. The helium comes in the Navy's standard tank semi-trailer



TEST TANK is part of Ames gun, mounts photo stations for data recording.

which doubles as the storage system.

Tunnel test times are as long as ten minutes at stagnation pressures as high as 2,000 psia.

Molecular Beam Tunnel

At the other end of the speed range is the University of California's molecular beam tunnel for the study of superaerodynamics. It resembles no other kind of wind tunnel. It looks like a miscellaneous collection of leftovers from a physics laboratory.

The major value of this tunnel is its operation at extremely low pressures down to one ten-millionth of a sea level atmosphere. The model is tested in an evacuated chamber in line with the tiny throat of the test section.

Diameter of the throat is one ten-thousandth of an inch. It is the outlet for a beam of molecules generated in a furnace whose temperature determines the speed of the molecular beam. For a furnace temperature of 1,800F the speed is 1,800 mph. The beam is focussed and controlled by a series of slits to produce the desired kind of test.

A by-product of the tunnel has been the development of an extremely sensitive electronic pressure gage which can detect changes on the order of one ten-billionth of a sea level atmosphere.

Speeds approaching Mach 40 and gas temperatures several times that of the sun's surface can be reached in the shock tube and its variation, the shock tunnel.

Shock Tube

The shock wave itself is used as the driving force in a shock tube. It rushes down the tube, driving the trapped gas ahead of it, compressing and heating it to test values. The whole process takes only a millisecond so that the temperatures involved never last long enough to do damage to the facility.

The geometry of the shock tube is simple. It is a long cylinder divided by a scored diaphragm designed to fail at a predetermined pressure. One side of the tube is pumped to a high pressure and held. That pressure is suddenly increased, either by an explosion inside or by a momentary increase in the pressure.

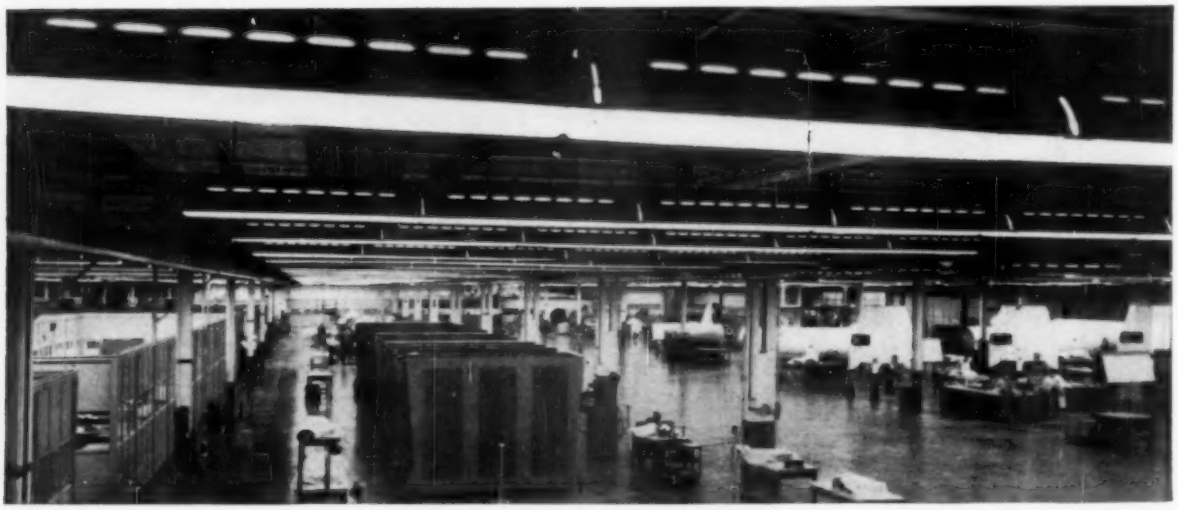
The diaphragm ruptures and the high-pressure air roars into the low-pressure section, producing a strong shock wave which races down the tube ahead of the pressure front. Compression of the air ahead of the shock wave produces a pocket of high-temperature gas which is the test fluid.

The only possible ways to get test results during a run of such short duration are photographic and electronics. Photos give qualitative data; only electronic instrumentation can give quantitative results. This is the major reason the shock tube has become an aerodynamic test tool only recently, although it was invented before the turn of this century.

A 100-ft. long shock tube is in operation at Avco Manufacturing Corp.'s Research Laboratory, simulating re-entry problems at speeds of nearly Mach 25 and gas temperatures approaching 15,000F. A shock tube under development at the University of Maryland is expected to reach Mach numbers of 40.

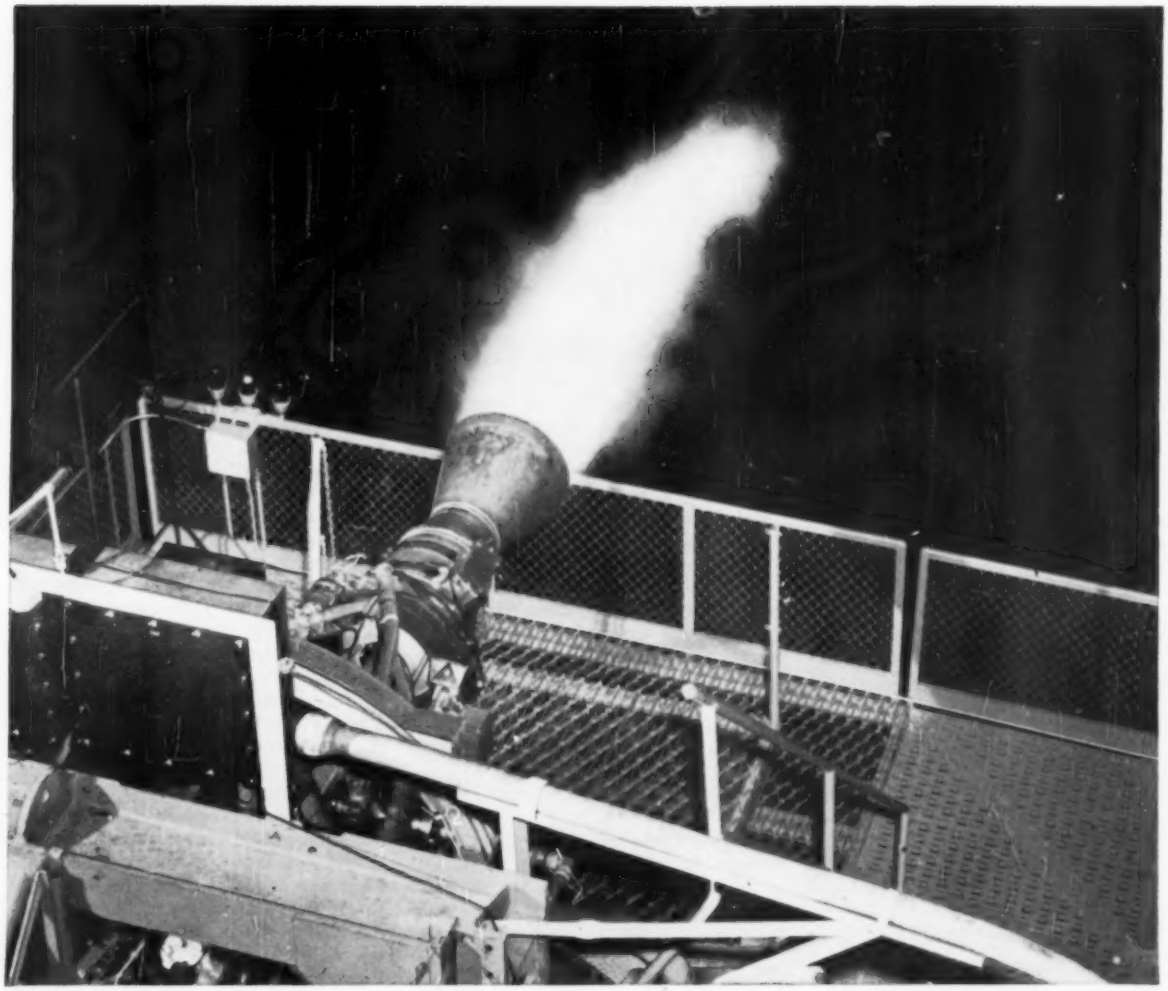
Shock Tunnel

By expanding the hot gas pocket through a supersonic nozzle it is possible to extend the useful range of the shock tube to a more accurate simulation of hypersonic flight. This has been done in the shock tunnels at Cornell



Chrysler Simulates Redstone Flight

CHRYSLER CORPORATION is simulating flight tests on Redstone missile (in shelter at top) in a laboratory at its Jet Engine Plant near Detroit. Data broadcast from missile by two telemetering transmitters is recorded by control room crew (right) on magnetic tape or strip charts. Chrysler engineers developed the shelter for testing whole missile as an addition to tests of components. It is made of woven wire conveyor webbing stretched over aluminum framework.



Night firing tests on early ROCKETDYNE engines helped speed the development of today's models whose power cannot be disclosed.

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Aeronautical Laboratory, where speeds in excess of Mach 22 have been produced.

The difference between the conditions of the shock tube and those of the shock tunnel arises because of the high temperatures generated during the process. The speed of sound increases with gas temperature increases. At the very high temperatures generated in the shock tube, the velocity of sound is also very high. The operating Mach numbers can be only moderately supersonic, at levels of Mach 2 or 3, for example.

Use of a supersonic nozzle means that the temperature can be dropped and the Mach number increased, trading temperature for Mach number right down to the desired test simulation.

In effect the shock tunnel becomes an intermittent blowdown type of wind tunnel with the driving medium being the high-pressure, high-temperature gas pocket produced in the shock tube.

Free-Flight Vehicles

The real value of the shock tunnel lies in its versatility. It is capable of producing simulated flight data on missile models or of studying the basic physical and chemical properties of the gases in the earth's atmosphere. It offers probably the best chance to determine the transient happenings behind a shock—the energy transfers, transport properties and relaxation times—and the relation between thermodynamic and electronic radiations.

Small, expendable models of full-scale aircraft and missiles have proven their value as free-flight test vehicles, simulating the dynamic characteristics of their big relatives under flight conditions. The size of such vehicles permits installation of sophisticated instrumentation to record and transmit data during flight. The transient and steady-state phenomena can be measured during a single flight to a high degree of accuracy.

In the field of hypersonic research the aerodynamic test vehicle is apt to become a specialized instrument for gathering specific kinds of data rather than for simulating a complete missile flight. Current examples of hypersonic test vehicles are being used to establish heat transfer data, particularly correlation factors for comparing the free-flight values with those obtained in wind tunnels and shock tubes.

One research rocket, the HTV (Hypersonic Test Vehicle) developed by Wright Air Development Center of the Air Research and Development Command in cooperation with Aerophysics Development Corp., has been used for aerothermodynamic flights almost exclusively.

The Lockheed X-17 hypersonic vehicle is another example of a current program. The X-17 is a three-stage solid propellant rocket.

Light Gas Guns

The art of ballistics, grown to a science during the past century, has contributed to the newest of flight regimes with the development of an unusual family of guns. Using light gases instead of powder charges, these research weapons—part of a general class called mass accelerators—can blast their projectiles at speeds starting at the 10,000 mph. mark and increasing to expected values approaching 20,000 mph.

The principle of these guns was developed at the New Mexico School of Mines from a proposal made by Dr. W. D. Crozier. The NMSM group under Dr. E. J. Workman developed a gun using hydrogen as the gas.

The reason for using a light gas stems from the fixed limit on total available energy in the propelling charge. When the energy is released, some of it goes into accelerating the projectile, the rest into accelerating the gas along with the projectile. Obviously the lighter the gas, the more energy available for accelerating the projectile.

Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics is operating a helium gun as the model for a larger future gun. The capacity of the model gun is a ¼-in. projectile and it has muzzle velocity of about 10,000 mph. The future gun will be able to handle projectiles up to ¾-in. at muzzle velocities of 16,000 mph. These test values will bracket the re-entry problem for any reasonable ICBM.

There are several ways to use the light gas gun. Normally fired through an atmospheric range, it can also be discharged into a tank with internal pressures and air compositions varied to simulate a trajectory or flight path.

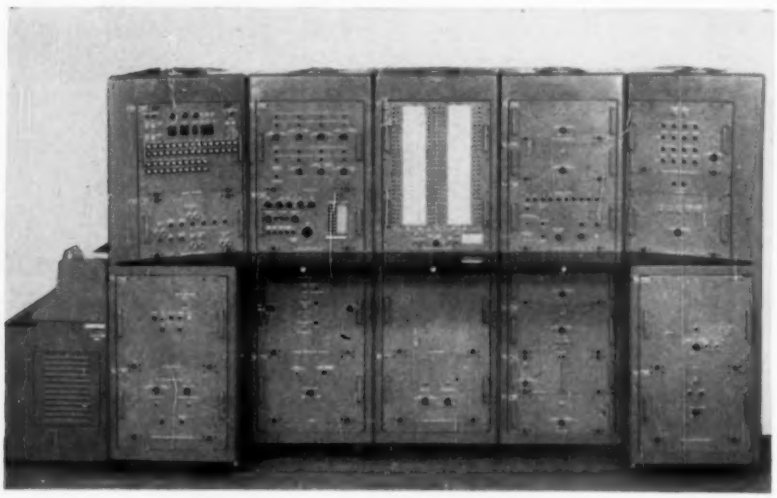
Another possibility is to fire the gun upstream through a wind tunnel working section, a technique proven at Ames during the past several years with conventional powder-driven guns. Expected speeds with the model helium gun fired into a supersonic wind tunnel reach Mach 20, the full-scale gun should provide velocities up to Mach 30.

Electrical Means

A high-current electric arc is a source of several times the heat energy found in chemical combustion. Hence this kind of a driving mechanism would seem to be a developmental step forward for the mass accelerator. Using an arch discharged in an atmosphere of helium, the limiting velocity is more than doubled, which indicates that practical values of perhaps 30,000 mph. could be achieved in actual testing.

It has also been suggested that the electrical arcs be discharged successively behind the projectile as it moves through the gun instead of only in the breech. This would reduce the rapid decay of the pressure which takes place behind the projectile and greatly increase the acceleration of the mass.

Two other approaches to obtaining high speeds involve the use of electro-



Simulator to Test Falcon

Hughes Aircraft's Falcon air-to-air missile will be given automatic check-out under simulated firing conditions using this elaborate automatic tester. Device prints out a permanent record of its findings on punched cards, giving quantitative indication of how far missile deviates from desired characteristics for use in quality control studies. Machine automatically tests its own accuracy against built-in standards, prints out results on punch cards. Tester was built by Electronic Engineering Co. of California.

magnetic energy. The first is a linear accelerator which would set up a field of rapidly moving electromagnetic waves and carry the test projectile along at extreme speeds by induction. This was tried experimentally in 1937 at the University of Utah.

The second technique would use the destructive bursting force generated in a coil when a high current is suddenly applied. In this case the test vehicle would be built as part of the coil and would be free to move in the radial direction of the bursting forces.

All of these techniques have been suggested and many of them tried as means of producing flight conditions in a laboratory. The listing is not a complete catalog; the history of development programs has shown that inventive, ingenious test techniques are developed as the programs grow. Ideas are borrowed and adapted from other fields of technology to turn out data.

Development programs live on these test results. No matter how complete the theory, how competent the analysis, there are gaps between the answers on paper and the answers in flight. The final value of the ICBM and the satellite programs will depend in large measure on the precision with which scientists and engineers can simulate and duplicate the strange conditions of flight in these new mediums.

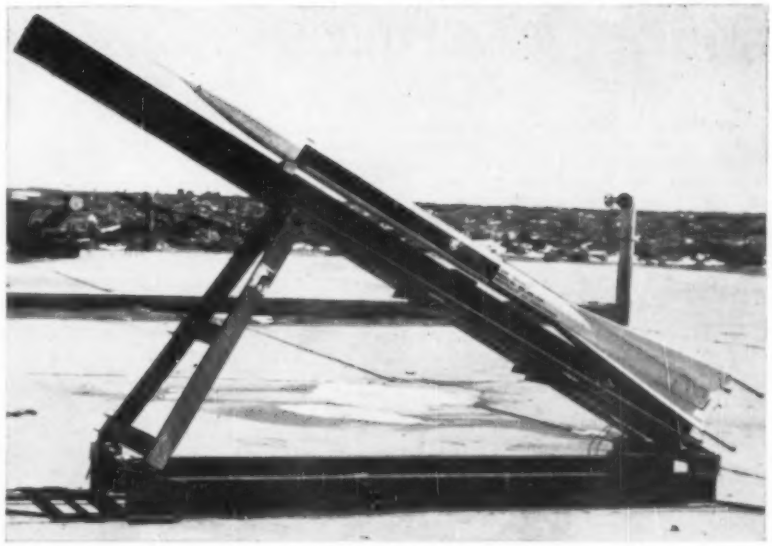
Asks Senate Program To Train Scientists

Washington—Sen. Mike Mansfield (D.-Mont.) has proposed a four-point program to help alleviate what he terms this country's "drastic, almost catastrophic shortage" of scientists and engineers.

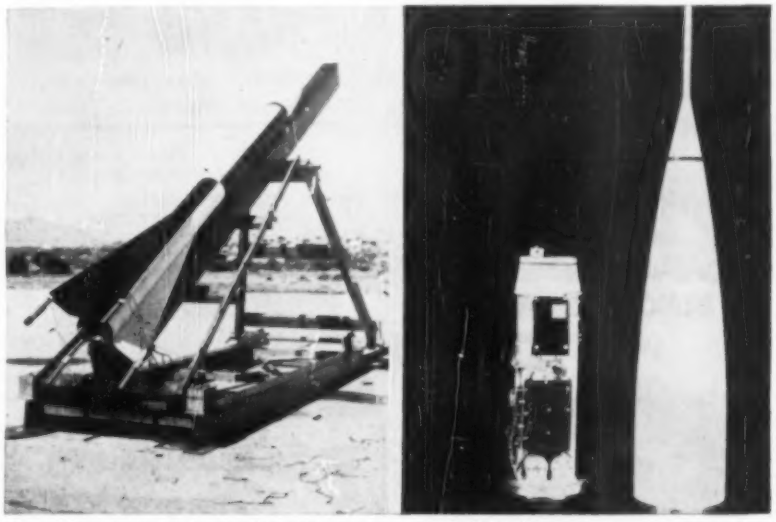
Pointing out that in 1954 the Soviet Union graduated 53,000 engineers and the U.S. 22,000, Mansfield asked the Senate to approve a program that would:

- **Expand the National Science** Foundation's scholarship program for college and graduate students in the natural sciences and engineering. Under the plan, the government would underwrite the college education of a selected number of high school students who display "special" capabilities.
- **Establish a federal** grant-in-aid program to help the states pay the salaries of high-school science and mathematics teachers.
- **Revise the Selective Service** program to make allowances for students and graduates studying the sciences and engineering. "They will be of much more value to the nation in the laboratories than they will behind a gun or typewriter."
- **Improve the job** and retirement security offered scientists, engineers and technical personnel.

Atmosphere Sounding Projectile



NAVY solid-propellant rocket, ASP, for gathering weather, cosmic ray data, can exceed Mach 5 shortly after launch. Horning-Cooper, Inc., Monrovia, Calif., developed it.



ASP, 12 ft. long, 6¼ in. in diameter, carries a small high frequency transmitter in head for relaying data to ground. Rocket is fired from portable racks.

Mounts Aid Missile Reliability

Teterboro Airport, N. J.—Missile development is speeded as much as two years by the proper application of custom-designed shock and vibration mounts that permit vital guidance and control equipment to survive during the brief but violent course of the weapons, according to C. S. Robinson, president of Robinson Aviation, Inc.

Robinson's remarks keynoted opening June 19 of a 42,000-sq.-ft. production and laboratory facility at Teterboro, twice the size of the firm's previous plant. The company makes a shock and vibration mounting system designed around a knitted resilient wire cushion.

One school of thought on mounting missile equipment is to beef up the systems for rigid attachment to the chassis, Robinson said. This method, he said, requires redesign and redevelopment of the avionic equipment, resulting in excess weight with no guarantee of success, and attendant waste of time, money and engineering talent.

The best approach is to call in vibration and shock mount specialists early, he said. One Robinson representative

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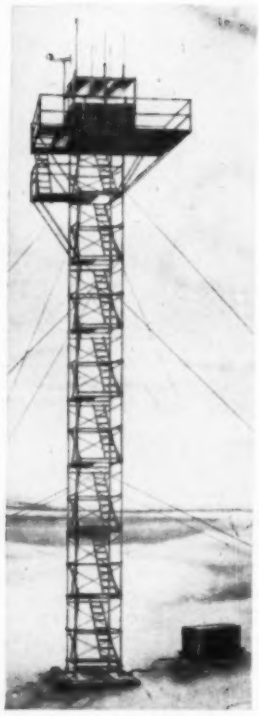

Inset shows portable tower being raised to top of structure, using hoisting equipment supplied. Sectionalized supporting structures are available in any height up to 250 feet.

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recalled early avionic equipment reliability problems that threatened the success of Chance Vought's Regulus. The Teterboro firm worked it out, but it took 50-60 mounting systems to handle the job. On projects where they have been called in early, fewer systems are installed. A concept favored by Robinson engineers is to put all possible guidance equipment in one shock-mounted package, rather than handle the various black boxes individually.

In addition to working with the airframe people, Robinson also is called in on problems involving shipment of equipment. One example was the stable platform built by Ford Instrument for Redstone. This delicate equipment had to be hand-packed and hand-carried to the airport for delivery, these precautions costing $800 per shipment. Robinson developed a mounting system for a reusable container costing about $800 that could be handled conventionally, saving a lot of money and effort.

The company has 2,500 different models of Met-L-Flex shock mounts of about 25 different basic designs in its files. Many of the components are standard, permitting a wide variation of configurations using basic hardware.

Applications are being extended into the industrial field, where the company is pushing the use of the mounts on machine tools. All heavy equipment in the new factory stands on shock mounts, reducing vibration and obviating the need for firmly fastening the equipment to the floors. This free-type mounting makes it easy to move machines or modify the plant layout.

The company's new laboratory has three times the former area. Among the new equipment is an MB electromagnetic vibration table that can operate up to 2,000 cps. Formerly mechanical shakers operating at 50 cps. had been adequate, but the increasing performance of new weapons has caused steady upward revision of specifications.

The company expects to do about $4 million business this year, its president noted, approximately 85% of it military. Total volume of aviation business handled by the shock mount industry is approximately $15-$20 million a year, he said.

Dominican Republic Lets Contract to Martin Co.

Baltimore, Md.—Generalissimo Trujillo of the Dominican Republic has announced his government has contracted with the Glenn L. Martin Co. of Baltimore for a nuclear-powered electrical generating system for his nation.

Under President Eisenhower's Atoms-for-Peace plan, contract is contingent on a bi-lateral agreement between United States and Dominican Republic.

The Sharpest "Nose" in the World

The "nose" of the Lockheed F104A Starfighter that stabs the sky at supersonic speed, presented radome problems rarely encountered by scientific technicians and reinforced plastics specialists.

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How to parry a jet's thrust

JET AIRMEN have to land 'em "hot" and fast—all the while hoping not to run out of runway or burn up their brakes in the process.

The simple solution would seem to be to slow the landing approach by simply cutting the throttle.

But once slowed below a certain level, some jet engines take as much as twelve seconds to regain full power.

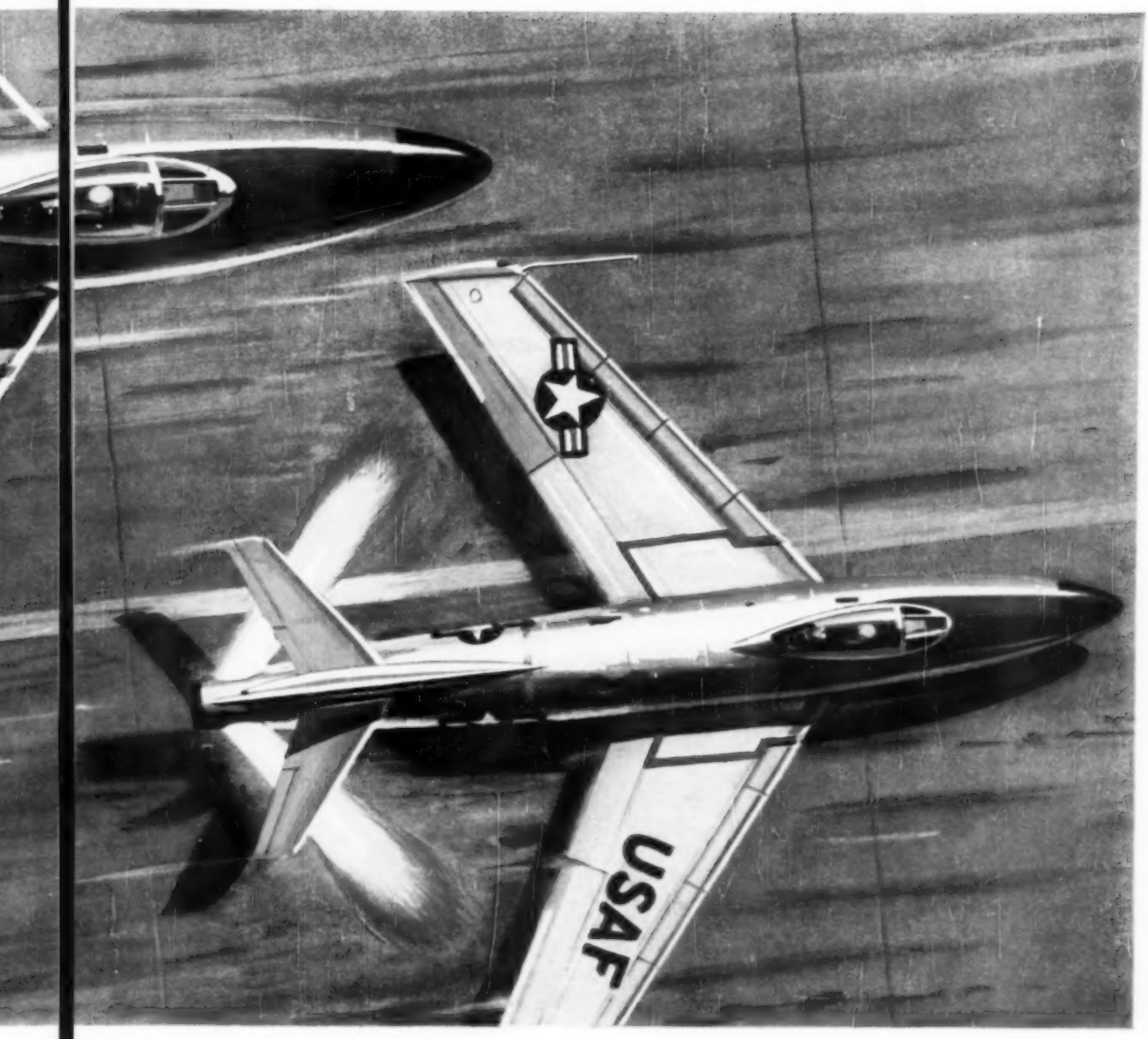
This power lag could spell trouble if the pilot had to "pull up and go around again."

Some time ago the Air Force asked Goodyear Aircraft Corporation to see if it could engineer a means of throwing a jet engine "into reverse"—so that its thrust could be utilized as a brake to slow these fast-landing planes once they touch the ground.

In effect, a device was needed which would serve the same function as the reversible pitch propellers used on piston-driven airliners.

But a jet is a different breed of cat from its piston-driven forebears.

To tame its forward thrust called for deflecting—changing the direction of—the white-hot rush of gasses which emerge from the engine's nozzle at sonic velocity.



Enlisting special high-temperature alloys to parry the tremendous thrust and heat, Goodyear Aircraft has successfully engineered Thrust Reversers for both afterburning and non-afterburning jet engines. Each meets the rigid Air Force requirements. *And more.*

Each includes a "fail-safe" feature which guards against accidental thrust deflection. Each offers savings in weight and money by pointing the way to elimination of conventional dive brakes and cumbersome deceleration chutes.

The result: better combat maneuverability, positive ground-control action which will eliminate the strain now being imposed on jet aircraft brakes at high speeds, shorter landing runs. In short, *a new margin of landing safety for this nation's jet airmen.*

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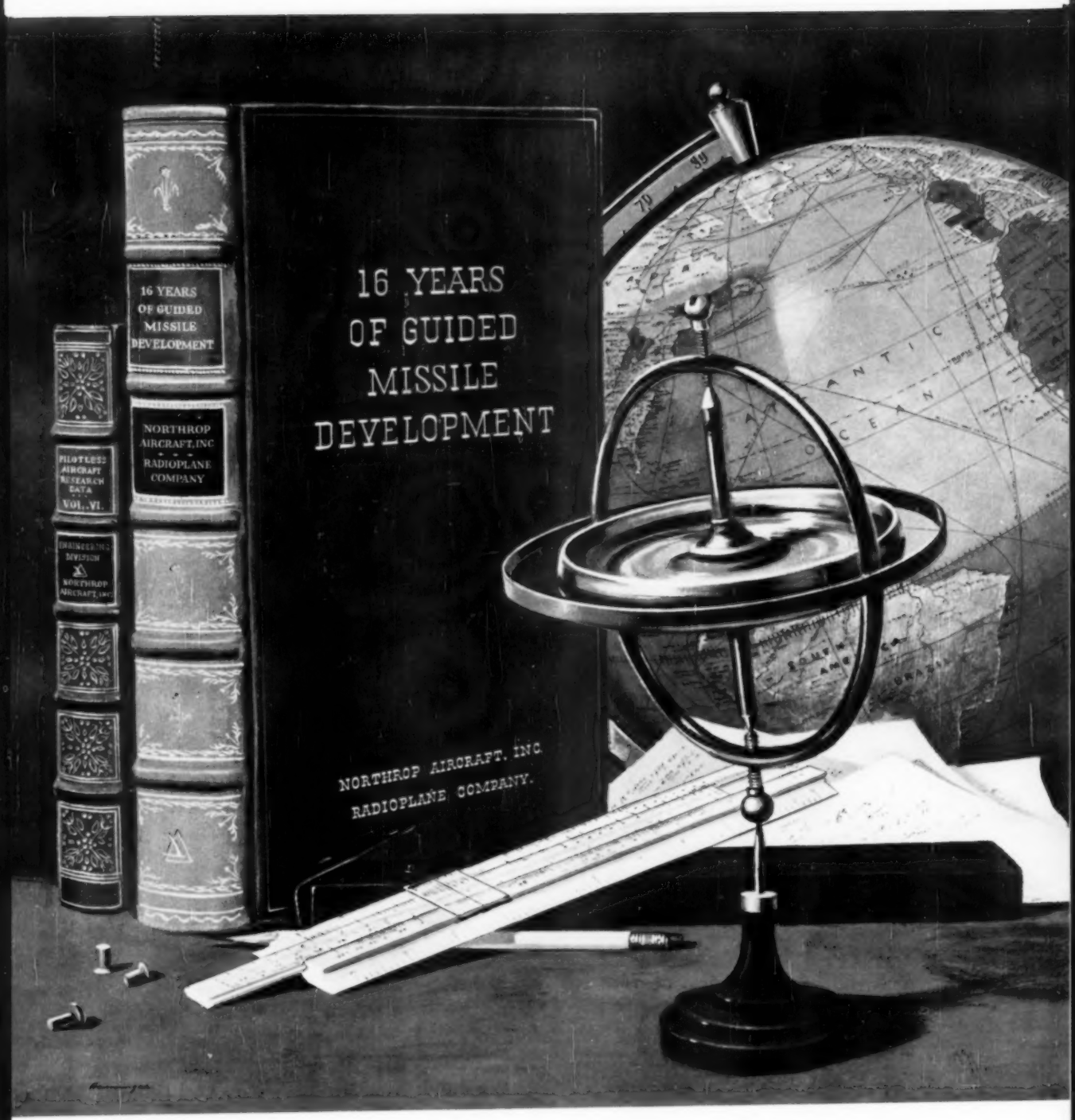

BALANCE—Foremost of Northrop achievements is an efficient organization well balanced between the poles of advanced research and economical production. Northrop scientists in physics, astronomy, metallurgy, electronics, aerodynamics, optics and many other fields are doing their work *years* in advance of the need. From such long-range thinking and planning within the Northrop complex have come the Radioplanes, first and foremost pilotless drones and missiles; Scorpion F-89 interceptors, present defenders of our heartland approaches; and Snark SM-62s, deadly intercontinental A-bomb carriers. As streamlined as its products, the well-balanced Northrop organization is at work on even greater weapons to strengthen this nation's defense . . . and is more ready than ever to develop and produce them efficiently and on schedule.

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Contractors Agree On ICBM Transducers

Pasadena—Requirements for pressure instrumentation in the intercontinental ballistic missile program were coordinated here at a symposium sponsored by G. M. Giannini & Co., Inc.

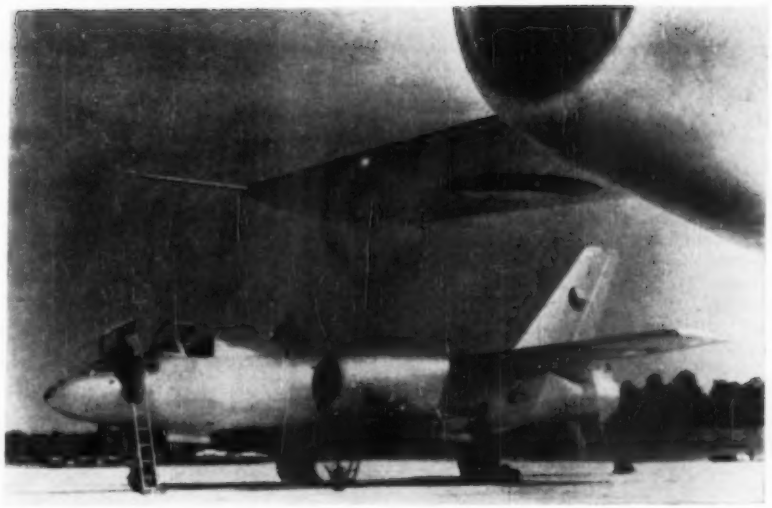
Attending were representatives of 14 contractors in the ICBM program, of the Air Research and Development Command representatives and Giannini.

Previously, Giannini had been approached by a number of the contractors with a series of requirements for pressure transducers for the ICBM program. These transducers, though basically similar, involved a number of substantial variations. Giannini officials felt that they could not supply these units in the short time allowed.

The contractor representatives were assembled at the symposium to determine whether transducer requirements could be consolidated to insure on-time delivery of the pressure instrumentation, and to eliminate possible production difficulties in later phases of the program.

Detailed demands for the pressure instrumentation were examined and suitable compromises were decided upon to facilitate delivery.

Also presented were specifications for new pressure transducers which will be available for production in the next year. It was felt that even these advanced units would have to be upgraded in the future.



Double Czech

First picture of Russian-designed U-Il-28 jet trainer (named Mascot in NATO code) in Czech markings. The plane is a development of the standard Ilyushin-designed light bomber which has been operational with the Russians and satellite countries for about five years. Powerplants are two RD45F turbojets rated at about 5,000 lb. static thrust each. Speed is in the 600-mph. class. Overall length is about 62 ft., and wingspan is 68 ft.

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Electra Structure Reveals Refinements

By Irving Stone

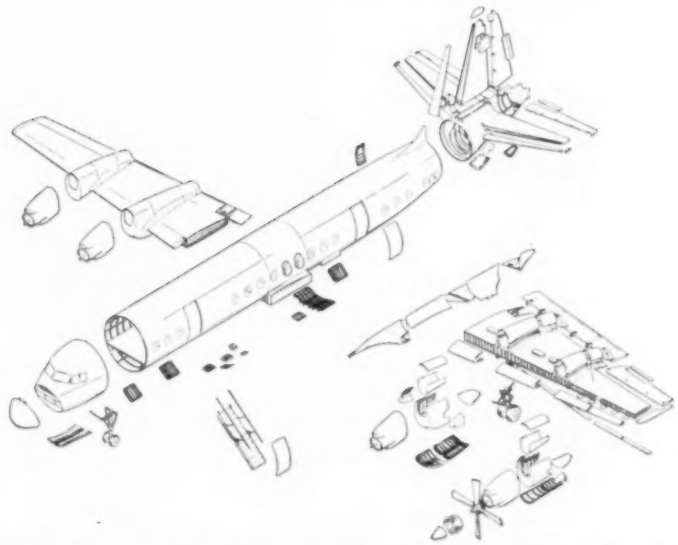
Burbank—Lockheed Aircraft Corp.'s turboprop-powered Electra embodies structural refinements based on the company's long experience in the transport field.

Integral stiffening has been effectively applied in the new design. Large single-piece forgings are used and chemical milling has been employed.

A general analysis of the Electra structure reveals these highlights:

- **Fuselage skin** is 2024 aluminum alloy supported by 7075 aluminum alloy C-rings at approximately 19 in. spacing and stringers at about 6 in. spacing.
- **Cabin floor** is supported by extruded transverse beams of 7078 aluminum alloy. These beams are chemically milled to remove excess weight.
- **Heavy extruded** 7075 ring frames are used in areas of cutouts, such as cabin doors and other access openings.
- **Massive 7075** forged frames are used to attach the fuselage to the front and rear wing beams.

A dome-shaped pressure bulkhead is installed at the rear of the fuselage, but a flat pressure bulkhead is used at the forward end to allow room for weather radar in the nose. Four doors in the forward bulkhead give access to instruments and controls.



EXPLODED VIEW shows flat pressure bulkhead forward, speed brakes (under wing carry-through), forward nacelle Q.E.C. unit, aft nacelle (of semi-monocoque construction).

Roomy Cockpit

Cockpit is extremely spacious and incorporates large windshield panels. These panels introduce problems of framing rigidity which have been solved by using heavy extruded 7075 posts and heavy 7075 sheet metal sills. To meet fail-safe requirements, each post is made up of dual elements and the sills also are of multiple-piece construction.

Two large 7075 truss type forgings, about 100 in. long, double in service by supporting the cockpit floor as well as the nose gear.

Separating the main cabin from the flight station is a bulkhead located at a major production joint. Underneath the main cabin floor and immediately aft of this bulkhead is the forward cargo and baggage compartment. Access to this area is through a door approximately 42 by 52 in. This door, like all others on the Electra, is an inward-opening plug type as a safety precaution to prevent door blowout from pressurization.

Structural reinforcement around this door is typical of all cutouts on the Electra. A chemically milled doubler is used to surround the opening and serve as an additional load path to prevent cracks from progressing into the basic shell.

In addition, the structural framework around the opening is a multiple-piece unit to meet fail-safe requirements.

Cabin windows are double pane construction. Outer pane is a primary pressure-carrying panel made from ¾-in.-thick stretched Plexiglas to prevent shattering. Inner safety panel is made from ¼-in. stretched Plexiglas.

Both panels are riveted to an aluminum spacer frame which in turn is bolted to a forged frame around the window.

Speed Brakes

Aft of the wing carry-through structure (center section) on the bottom of the fuselage are mounted three speed brakes. These are of sheet metal construction with forged fittings. Center speed brake is 26 x 42 in., outer units are 35 x 42 in.

Horizontal stabilizer and fuselage cone aft of the rear pressure bulkhead is a single assembly.

Vertical and horizontal stabilizers use four-spar construction with 7075 skins and extruded stringers of the same alloy. The four-spar makeup has been found by Lockheed engineers to be lighter than the conventional two-spar construction and affords multiple load paths to meet fail-safe requirements.

Trailing edge structure between stabilizer rear beam and control surface is of sandwich construction.

Stabilizer leading edges are electrically heated for anti-icing. Sandwich type construction is used, with inner and outer skins bonded to a non-conducting core. Leading edge ribs are attached to inner skin only.

Wing consists of a center section (carry-through structure) and outer panels extending from fuselage to the tip.

Front and rear spar webs are machined 7075 plate tapered in thickness from root to tip. Padded areas on the webs provide reinforcement at location of concentrated loads.

Web stiffeners, spaced at approximately 6 in., are extruded 7075 bulb T sections. These are designed to pick up the shear load from a failed web and transfer it to the beam caps.

Fail-Safe Wing

Upper and lower wing surfaces consist of nine spanwise panels machined from integrally stiffened extrusions 17 in. wide. The 17-in. panel width is established by a fail-safe requirement so that failure of any one panel will not induce failure into adjacent panels.

Lower skin material is 7075. Upper skin is 7078 for its better compressive strength.

Skin panels are machined not only to taper the skin and stiffener height, but stiffener thickness as well in order to save additional weight. These tapers are not constant but are varied to conform to spanwise load distribution.

Truss ribs between front and rear spars consist of extruded upper and lower cap members and diagonal braces. Cap members are chemically milled to obtain optimum thickness for minimum weight.

Landing gear ribs are large single-piece 7075 forgings about 100 in. long and about 24 in. deep.

Entire outer wing panel consists of two tanks. The inboard tank extends from the fuselage joint to the inboard nacelle. Outboard tank extends from outboard of the inboard nacelle to the tip.

This arrangement keeps fuel out of the area of the fuselage and the landing gear.

Access to the inboard tank is through a two-rib-bay door in the upper surface. Access to the outboard tank is through a single three-rib-bay door in the upper surface between nacelles and through five single-rib-bay doors in the lower surface outboard of the outer nacelle.

Shear-Tension Combination

Joint between outer wing panel and center section is a combination shear and tension type. Upper and lower wing surfaces and front and rear spar webs are connected with shear type splice plates.

Upper and lower spar caps of the two wing sections are joined with 7075 forged tension bathtub fittings. Center section bathtub tension fittings are an integral part of the fuselage-to-wing attachment frames.

Wing leading edges are anti-iced by bleed air from the turbine engines. This air is distributed to the leading edges through nozzles spaced along a "piccolo" tube within the leading edge. The hot air is discharged into stamped inner skin to distribute it chordwise.

Flaps are Fowler-type units which roll on forged steel tracks. Flaps on left and right hand wing panels are interchangeable.

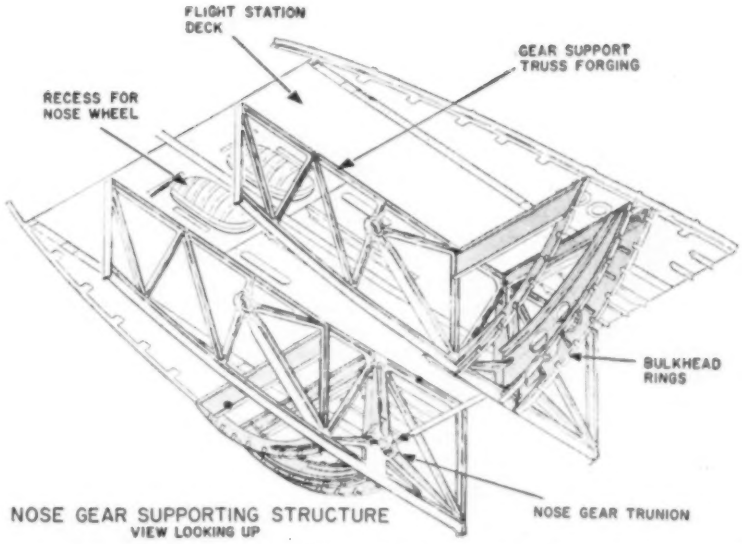
Each powerplant installation consists of a quick engine change (Q.E.C.) unit and an aft nacelle portion. Q.E.C. units, which accommodate the engine, gear box, accessories and propeller, are interchangeable in all four engine positions.

Inboard engine aft nacelles, which house the landing gear, are alike and wider than the aft sections of the outboard nacelles.

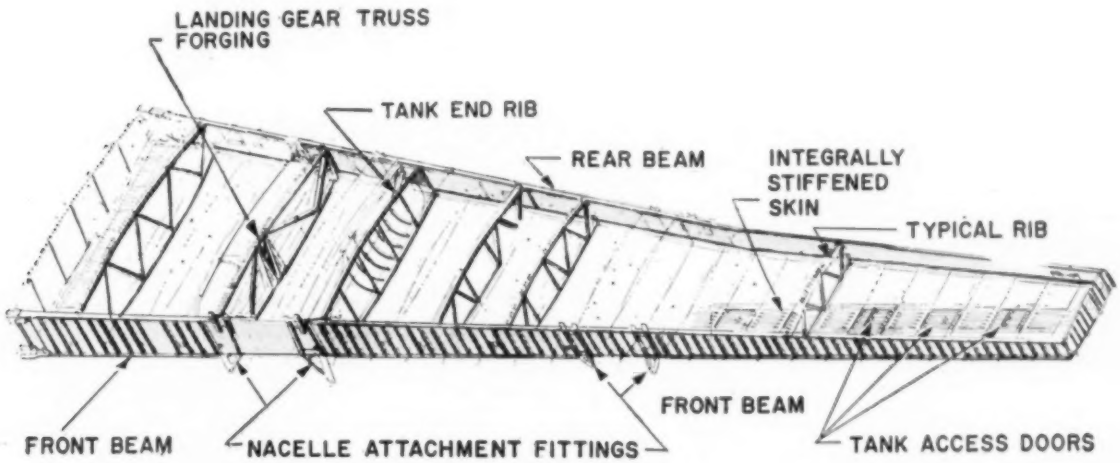
Q.E.C. Structure

The primary structure of the Q.E.C. unit consists of upper and lower steel-reinforced aluminum panels connected by steel diagonal side braces.

Engine reactions are transmitted to this panel structure by a heavy steel and aluminum ring around the gear case. Area between upper and lower panels is en-



TWO LARGE 7075 truss-type forgings about 100 in. long double in service by supporting the cockpit floor as well as the nose gear. Arrows mark details.



LEFT WING STRUCTURE, UPPER SKIN REMOVED

EXTRUDED upper and lower cap members and diagonal braces are feature of truss rib between spars. Cap members are chemically milled.

closed by a hinged non-structural cowl door.

The Q.E.C. unit is attached to the aft nacelle by four tension bolts.

Semi-Monocoque Aft

The aft nacelles are of semi-monocoque construction with titanium alloy skins and titanium and aluminum alloy frames and stiffeners. Internal shrouds and firewalls are stainless steel.

Landing gear doors and access doors use titanium alloy skins with aluminum alloy substructure.

Nacelles are attached to the wing with stainless steel angles along upper and lower wing surfaces and with steel plates at the front wing beam. Nacelle wing fillets are made of titanium alloy.

Landing gear shock and drag struts are made of 4340 steel, heat-treated to 260,000-280,000 psi. ultimate tensile strength. Using this heat treat strength level instead of 190,000 psi. uts. commonly used, is estimated to save approximately 300 lb. in gear weight.

Careful attention has been paid to detail design of the landing gear with respect to such items as intersection radiuses, areas of stress concentration, and use of reduced allowable unit stresses where stress distributions are indeterminate.

An auxiliary automatic mechanical down-lock is incorporated in the gear to prevent inadvertent retraction while the plane is on the ground.

Lockheed Expansion To Cost $19 Million

Burbank, Calif.—To turn out $458 million of new transport orders, Lockheed Aircraft Corp. has begun work on $19 million in expansions and improvements at its California Division plants. This expenditure for fixed assets is twice that of any previous year. The work is first step in a $92 million growth plan. The money will go for:

- **First units** of a proposed new engineering test center, providing an 80,000 sq. ft. flight test hangar and an 87,000 sq. ft. shop, laboratory and office structure, to cost $7 million.
- **New paint hangar** large enough for 150-ft. wings of 1649 Constellation scheduled to fly in four months.
- **New building** for fuel tank sealing and testing.
- **Conversion** of former overhaul facilities of Lockheed Aircraft Service, Inc., into assembly lines for Electra, at cost of about $500,000.
- **Machinery worth $4 million** including $300,000 below-ground heat treat furnace for new types of steel alloys; a $300,000 stretch-forming device that stretch-wraps parts into a full circle, and a $250,000 battery of automatic riveting machines.
- **Preliminary studies** on a proposed supersonic wind tunnel.

Burt C. Monesmith, Lockheed vice-president, said that Lockheed recently received a contract which may lead to a production order for a reconnaissance jet. Other military work for jet trainers, anti-submarine planes, F-104 fighters, early-warning Constellations is under negotiation, and commercial airliner sales outlook is bright, he said.

Boeing to Build New B-52 Painting Hangar

Seattle, Wash.—Boeing Airplane Co., plans to build a $4.7 million painting hangar at Moses Lake, Wash., to be completed next year.

The building will be a 450 x 187-ft. two-place hangar with low ceiling and two raised, slotted sections in the roof to clear the vertical tails of B-52 bombers. The planes are built in Seattle and tested at Moses Lake.

All exterior painting of B-52s will be done at Moses Lake. Currently, the painting is being done in Seattle.

Presenting the New QWL

Bendix ELECTRICAL CONNECTOR

A HEAVY-DUTY WATERPROOF POWER AND CONTROL CONNECTOR FOR USE WITH MULTI-CONDUCTOR CABLE

This new QWL Bendix* Electrical Connector was designed for and is being used principally on ground-launching equipment for missiles and ground radar equipment.

Obviously, for this important type of service only the highest standards of design and materials are acceptable.

That's why it will pay you to specify the Bendix QWL Electrical Connector for any job that requires exceptional performance over long periods of time.

QWL outstanding features:

1. It combines the strength advantages of machined bar stock aluminum with the shock-resistant qualities of a resilient insert.
2. A modified, double stub thread provides for speed and convenience in mating and disconnecting and the special tapered cross-section thread design resists loosening under vibration. The threads can be easily hand cleaned if contaminated by a substance such as mud or sand.
3. An Alumilite 225 hard anodic finish is used which gives a case hardening to the aluminum surface. This finish offers outstanding resistance to corrosion and abrasion.
4. The cable-compressing gland used within the cable accessory accomplishes both a firm anchoring of the cable and effective waterproofing for multi-conductor cables. Neoprene sealing gaskets are used at every joint to insure a watertight connector assembly.
5. The cable accessory is designed to accommodate a Kellems stainless steel wire strain relief grip for additional cable locking.
6. A left-hand thread is used on the cable accessory to prevent inadvertent loosening.
7. High-grade copper alloy contacts are used which provide for high current capacity and low voltage drop. The famous Bendix closed-entry socket is used for contacts sizes 12 and 16.

*TRADEMARK

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Liquid Metal Is Potential Igniter

A liquid metal, aluminum trimethyl, that flames instantly upon contact with air or oxygen is in production by a Denver chemical firm, Rocky Mountain Research, Inc. The product will find increasing use as a rocket fuel and possibly as an igniting agent for rocket and jet engines, the firm believes.

E. F. Van Dersarl, president of the firm, said it might also be used as an additive for jet fuel to maintain flame propagation at very high altitudes and high speeds.

Van Dersarl said the product, because of its self-igniting properties, could be used as an emergency fuel to relight jet engines after a flameout. Only a relatively small amount would be needed. He said tests in simulated air pressure of 60,000 ft. altitude showed aluminum trimethyl has very satisfactory spontaneous ignition properties

The product has been furnished to the Air Force for research, Van Dersarl said. To his knowledge, Rocky Mountain Research is the only firm that has brought aluminum trimethyl into commercial production.

"Cost per lb. is relatively expensive," he said, "but the cost can be lowered to a few dollars a lb. when we get a contract that would keep our production facilities operating for a year or two."

Van Dersarl said the production costs are high because only chemical engineers have been used to operate the producing facilities and equipment. While declining to specify exact production capacity at his plant, Van Dersarl said he believed it would equal or exceed production of any metallic compound of its type.

Since aluminum trimethyl is in liquid form, Van Dersarl said, it overcomes a problem encountered by the National Advisory Committee for Aeronautics in tests with aluminum powder and aluminum rod to fuel a ram jet engine.

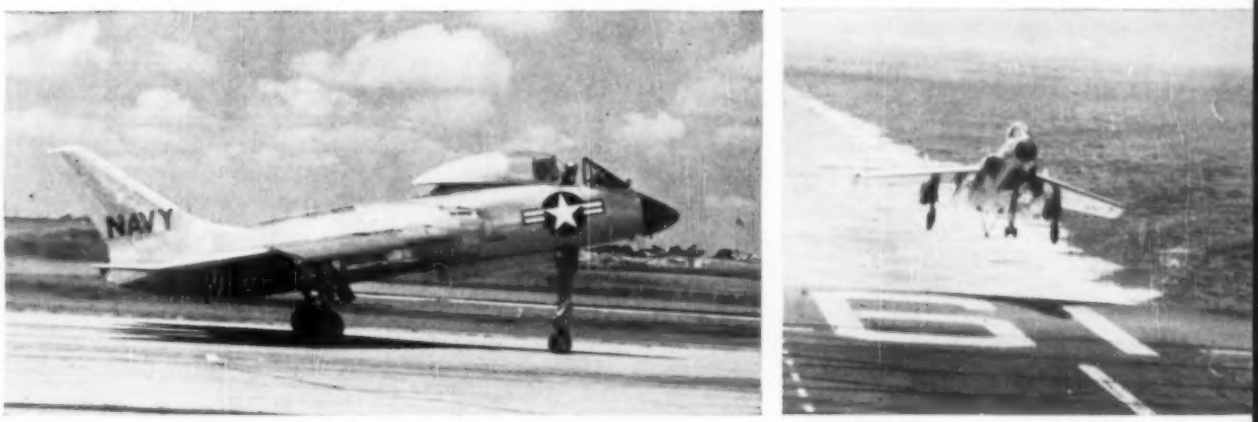
Extreme care must be exercised to keep the aluminum trimethyl from contact with air or oxygen. However, Van Dersarl said, engineers have suffered no injuries in the 18 months they have been experimenting with it.

"Samples of the product have been evaluated as a polymerization catalyst in the new isoprene and polyethylene processes with very favorable results," Van Dersarl added.

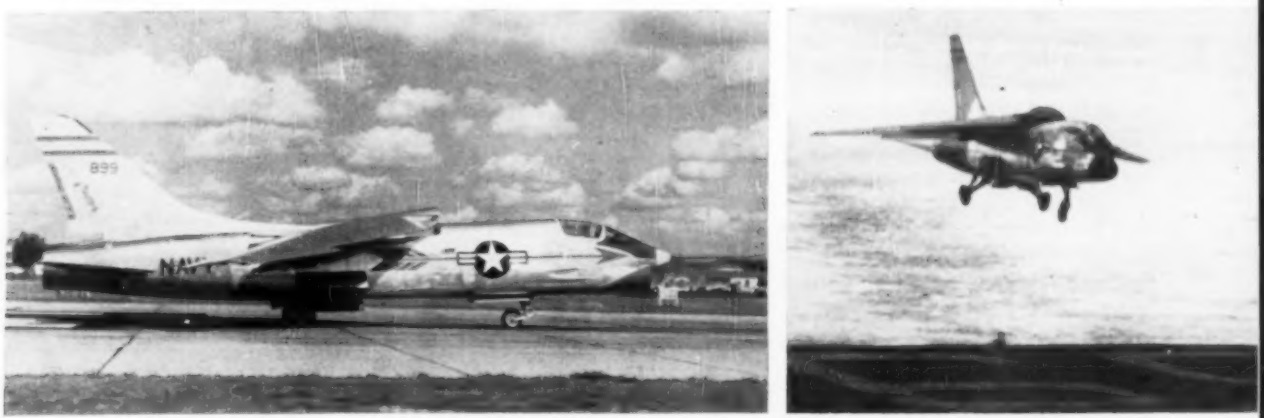
Ultrasonics Firm Wins Guided Missile Contract

Air Force has awarded a development contract in the guided missile field to Acoustica Associates, Inc., Glenwood Landing, N. Y., manufacturers of ultrasonic cleaning and measuring equipment.

Carrier Visibility of F7U, F8U Compared



NOSE HIGH attitude of F7U on runway is reflected in minimum speed approach to carrier Hancock, which has no angled deck.



WING RAISED forward, the F8U is almost parallel to deck. Full-power is usable in approach to angled-deck Forrestal.

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NON-MAGNETIC AIRCRAFT CABLES

- GOOD THERMAL CHARACTERISTICS
- CORROSION RESISTANT
- HIGH FATIGUE RESISTANCE
- HIGH ABRASION RESISTANCE
- PREFORMED CONSTRUCTION

Eliminates Instrument Interference!

• Just as we expected, many aircraft designers were interested in the recent announcement of our new non-magnetic aircraft cable. If you did not see it, "NO-MAG" has these characteristics:

NON-MAGNETIC PROPERTIES . . . "NO-MAG" cable is made from type 305 stainless steel. It remains non-magnetic after severe cold working —in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetism after swaging, wire drawing or similar operations.

This non-magnetic property of "NO-MAG" cable eliminates instrument interference from cable magnetism.

CORROSION RESISTANCE . . . New "NO-MAG" cables have corrosion-resistant qualities similar to, but slightly better than, cables made of standard stainless steel.

GOOD THERMAL CHARACTERISTICS... The thermal expansion characteristics of new "NO-MAG" cable are much closer than those of standard stainless steel or carbon steel cables to the characteristics of aluminum alloys used in aircraft. This greatly simplifies maintaining cable tension under various changes in temperature.

HIGH FATIGUE RESISTANCE . . . Preformed construction and careful processing give new "NO-MAG" cable high fatigue resistance.

HIGH ABRASION RESISTANCE . . . New "NO-MAG" cable shows greater abrasion resistance than standard stainless steel aircraft cables.

TENSILE STRENGTH, while lower than that of stainless and carbon steel, is sufficient to enable replacing these, size for size, with "NO-MAG" on many applications where the characteristics of "NO-MAG" are required.

USE WITH SWAGED TERMINALS . . . Swaged terminals can be applied to standard AN dimensions.

COMPLETE RANGE OF SIZES, CONSTRUCTIONS . . . New "NO-MAG" is furnished in sizes from 1/16" to 1" in all of the standard aircraft cable constructions.

Get the complete story on this new technical development for the aircraft industry. Write today to Detroit office.

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McDonnell Organizes Research Department

The problems of applied science and engineering research will form the major mission of McDonnell Aircraft Corp.'s new research department headed by Dr. Albert E. Lombard, Jr.

The department is intended to supplement and contribute to the work of McDonnell's engineering divisions and flight department. The organization will report through Lombard to Kendall Perkins, vice president-engineering.

Perkins said the research department will work on a variety of projects initiated either by the government, one of the engineering divisions or the department itself. The projects must offer promise of technical improvement in future aircraft and weapon systems, he added.

Lombard was associated with the Directorate of Research and Development, USAF, prior to his employment by McDonnell. In 1949 he was named scientific advisor at USAF Headquarters. His background also includes service with the War Production Board on aircraft planning, industrial experience at Convair and Curtiss-Wright Corp., and teaching at the California Institute of Technology.

PRODUCTION BRIEFING

The Talley Corp. (formerly known as the Talley Machine & Manufacturing Corp.) is in the process of moving out to its new location on Ventura Blvd., Newbury Park, Calif. Talley is designing and manufacturing aircraft accessories, electromechanical actuators and hot-air valves.

General Electric's Medium Steam Turbine, Generator and Gear Dept., Lynn, Mass., believes that its know-how in high speed gearing may become of service to the aircraft industry. The department now is in a five year, $23,000,000 expansion and modernization program.

Expansion is going on at all three Lear, Inc., plants. Totalling 3.6 million, the expansion breaks down into 200,000 sq. ft. of Santa Monica, Calif., 14,000 sq. ft. at Elyria, Ohio and 170,000 sq. ft. at Grand Rapids, Mich.

To meet increased demands for its products, American Bosch Arma Corp., has initiated a $1,164,000 addition to its Columbus, Miss., plant. This doubles the space of the Mississippi facility. The company also is more than half way through a $1.5 million modernization program at its division

at Springfield, Mass., and is moving the executive offices out of the Garden City plant to make room for more engineering offices. The new general offices will be in nearby Hempstead, N. Y.

Varian Associates, Palo Alto, Calif., electronics firm, plans to grow to three times its present size in the next three years. Final size will be 500,000 sq. ft. of research, development, manufacturing and administrative areas.

Jack & Heintz, Inc., Cleveland, has purchased two plants in nearby Bedford Heights, Ohio, for systems research and prototype production.

American Machine & Foundry Co., has been assigned a 200,000 sq. ft. plant in Rochester, N. Y., by the Air Force, and an $11,000,000 initial production contract by the Radio Corp. of America, as AMF's part of an RCA-Air Force missile system contract.

Curtiss-Wright Corp., Wood-Ridge, N. J., is adding an 80 sq. mi. Nuclear Materials Laboratory as part of its Air Force nuclear propulsion program.

NEW AVIATION PRODUCTS

A pneumatic starter for commercial jet engines, an aircraft cabin heater testing unit and a test stand that checks out propeller synchronization under simulated flight conditions are the latest developments placed on the market by a New York equipment firm.

• **Pneumatic jet engine starter Z784,** was originally designed for the U. S. Air Force, and is capable of starting powerplants, such as the P&WA J57 in less than 30 sec., the maker reports. Truck-mounted (see photo), the gas-engine-driven two-stage compressor delivers 125 lb./min. of air at 55 psia. and 550F outlet temperature. The starter automatically unplugs itself from the engine.

• **Cabin heater tester JH-2** accommodates units through 600,000 Btu./hr. with dimensions to 60-in. long and 16 in. diameter. Blower capacity is 2,200 cfpm. at 20 in. of water, flowmeter capacity to 60 pph. of Iso octane and 24-in. manometer capacity. Flow char-

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F4D Skyray . . . Navy's Sunday Punch!

The Navy's F4D Skyray — newest all-weather fleet interceptor — gets its deadly sting from its Westinghouse Aero 13 armament control system.

Visibility good, or zero — when a Navy pilot is searching out enemy targets in a Douglas F4D, a blip on his Aero 13 radarscope shows him where the invading planes are. He selects the appropriate target and locks on, tracking. The Aero 13 computer calculates the proper attack course (at the pilot's option) until the target is in range. Directed by the Aero 13, the weapons are fired at the right instant — another intercept mission is accomplished!

The Aero 13 embodies advanced design for convenience of installation and maintenance, by cylindrical packaging, which is adaptable for the nose of any modern high-speed fighter aircraft. It consists of hinged panels which can be swung outward and downward for quick maintenance.

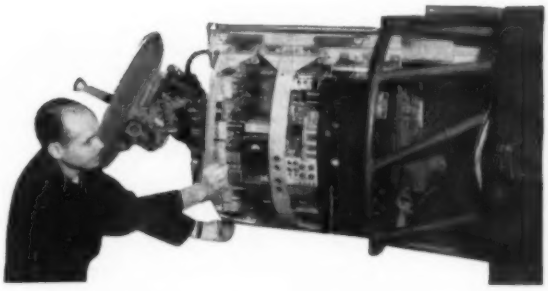
Each panel section in turn contains removable subassemblies. Complete circuits can be checked with test

U. S. Navy Photo

equipment similar to an ordinary tube tester. Built-in test points in the radar subassemblies provide quick localizing of trouble.

Latest in the Air Arm fire control series, the Aero 13 is a refinement of an earlier Westinghouse development that scored the first blind kill of an enemy aircraft over Korea. It is one more example of creative engineering by Westinghouse — airborne defense systems to keep America free.

For assistance in specific fields of airborne electronics defense systems, contact Westinghouse Electric Corporation, Air Arm Division, Friendship International Airport, Baltimore 27, Md. J-91049



The Aero 13 incorporates the complete radar and computing system in a unique barrel-type package which fits perfectly in the nose of the aircraft. Overhead slide-rail mounting provides easy pull-out for service.

The Air Arm Systems Family

Fighter Armament	Bomber Defense	Flight Control
Missile Guidance	Special Purpose	Systems Components

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MALLORY·SHARON reports on

TITANIUM

More TITANIUM CAPACITY

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• With the turn of a dial, the first new titanium melting furnace in Mallory-Sharon's current expansion program goes into operation. Like its predecessors, it is remotely controlled from a master panel, with actual melting operations conducted in heavy vaults.

Meanwhile, construction of several additional, larger furnaces is underway. The result will be a tripling of our capacity by January, 1957. All these facilities are based on "Method S"—the consumable electrode double melting process which Mallory-Sharon introduced—and which is now the standard of the industry.

Titanium's strength, lightness, and corrosion resistance have built a demand that's unprecedented for a new metal. Mallory-Sharon intends to meet the need with mill products of the highest quality.

MALLORY-SHARON TITANIUM CORPORATION, NILES, OHIO

MALLORY Ti SHARON

teristics are controlled using an iris valve.

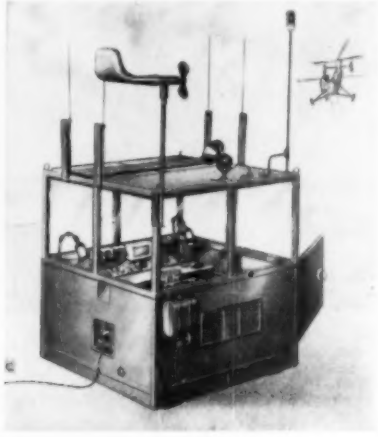
• **Propeller synchronizer tester PS-4,** designed in conjunction with Hamilton Standard Division of United Aircraft Corp., is a self-contained floor-mounted unit. Power supply provides infinite voltage control to energize the circuit under test. Having four electronic variable speed drives, the machine can check new or overhauled synchronizers, tachometer generators and stepmotor heads.

Greer Hydraulics, Inc., New York International Airport, Jamaica 30, N. Y.

Helicopter Moves Control Tower

A complete airport control tower with air conditioning and heating, that can be transported by helicopter, plane or truck, is now available to civilians. Unit comprises radio-telephone, transmitting and receiving equipment, aerological instruments, field lighting control facilities and provision for field telephones.

Wickes Engineering & Construction Co., 12th St. & Ferry Ave., Camden 4, N. J.



Pump for Missile Pressure

Positive displacement rotary vane pump RG-10090-C for missile pressurizing applications or for supplying oil-free air to avionic equipment, has 0.8008 cu. in. displacement per revolution. No seals or packing are used. Positive starting and pumping is possible at −65F. Rated capacity is 700 cu. in./min. at 68F. There is no loss of system pressure through pump when it is stopped during intermittent operation.

Motor is 0.333 hp. at 48 rpm. with 115 v. a.c., 400-cycle three-phase 480-maximum watts continuous-duty at 20,000 ft. ambient altitude.

Lear-Romec Division, Lear, Inc., Elyria, Ohio.

Mystere 24 Model

French Interceptor designed by Societe Generale Aeronautique Marcel Dassault is under construction at the company's main production plant at Merignac near Bordeaux. Built as a private venture, the Mystere 24 will be powered by a Snecma Atar G turbojet rated at 9,700 lb. sea level static thrust. Details of this and its two sister ships—Mysteres 22 and 26—appeared in Aviation Week, Oct. 10, 1955, p. 26.

ALSO ON THE MARKET

F & P Ratolarm, vibration-proof flow alarm, uses two snap-action electrical contacts which are drawn together to set off alarm by passage of a magnetic float extension rod. Switch can be positioned in mounting frame either above or below the magnet in float extension rod to give a signal for either high or low limits of flow. Multiple alarms may be incorporated for special applications. —Fischer & Porter Co., 553 Jacksonville Rd., Hatboro, Pa.

Statistical accelerometer counts number of times pre-selected G levels are equalled or exceeded. Unit can be furnished with four-channels or five-channels, with each sensing element arranged to respond to acceleration in one of two planes and in one direction for the selected plane. Each channel can be factory-set to count at any level from 2.5 to 10 Gs absolute, in increments of 0.5 G minimum; accuracy of setting is 0.2 G (static calibration).—Maxson Instruments, Division of W. L. Maxson Corp., 47-37 Austell Place, Long Island City 1, N. Y.

Overheat detection unit developed to prevent overheating and damage to aircraft windshields. Unit consists of sensing probe containing a thermistor detector and a control box containing amplifier and control circuit. Detector is adjustable over range of 170-270 F with a maximum differential of ±10F throughout the range; it conforms to applicable sections of government environmental specification MIL-E-5272A. —Aviation Products Division, Fenwal, Inc., Ashland, Mass.

Intervalometer, equipped with as many as eight timing switches, operates at different intervals varying from 0.01 to 20 sec. Unit may be adapted to perform any operation that can be undertaken by automatic switches, and is being used in fire-control systems and automatic guidance systems in aircraft. Item has double-flange mount and is 1¾ in. in diameter.—Motronics, Corp., 241 Concord St., Glendale, Calif.

Micro-hardness tester and metallurgical microscope, of non-destructive type, has a load-weight range of from 25 to 1,000 grams and requires only one minute for a complete test cycle. Interchangeable vise accessories permit unit to be used for testing small precision ground or lapped parts, small diameter wires, very thin materials, etc. Vertical capacity is 2⅜ in. and maximum spread of standard vise jaws is 1⅛ in. Camera can be attached to eyepiece for making photomicrographs.—Sheffield Corp., Dayton, Ohio.

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SHINE LONGER

SHINE EASIER with

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Aluminum Cleaner and Polish

The original chemically-impregnated cotton wadding — Cleans quicker, gives higher, longer-lasting gloss, leaves protective film. Saves time, labor and money! Avoid inferior imitations.

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Clifton Precision's new Size 8 series of Synchros is in production and providing the highest accuracy and reliability in the industry. Samples from stock. Write or phone MAdison 6-2101 (Suburban Philadelphia)

ILLUSTRATIONS ACTUAL SIZE

ALL TYPES AVAILABLE

STANDARD UNITS

SYNCHRO FUNCTION	CPPC TYPE	ROTOR Input V400cy	Input Amps	Input Watts	Ohms (DC)	Output Rotor	Sensitivity (MV deg.)	STATOR Output Volts	Sensitivity (MV deg.)	Input Volts	Input Amps	Input Watts	Ohms (DC)	IMPEDANCE Zro	Zso	Zrss	Phase R-S	Shift S-R	Nulls (MV)	Possible Error	Possible Spd.	Length in inches
Torque Transmitter	CGC-8-A-7	26.0	100	.5	37	—	—	11.8	200	—	—	—	12	54+j260	12+j45	76.4+j19.6	8°	—	30	7'	14'	1.240
Control Transformer	CTC-8-A-1	26.0	.050	.25	143	24	410	11.8	200	11.8	.090	.23	25	220+j740	28+j110	246+j60		8.5°	30	7'	14'	1.240
Control Transformer	CTC-8-A-4	—	—	—	381	24	410	—	—	11.8	.037	09	60	508+j1680	67+j270	640+j190	—	9.2°	30	7'	14'	1.240
Control Differential	CDC-8-A-1	—	—	—	36	11.8	200	—	—	11.8	.085	.21	25	38+j122	27+j120	48.6+j13.8	—	9°	30	7'	14'	1.240
Electrical Resolver	CSC-8-A-1	26.0	.039	.43	230	23.2	400	10.6	180	11.8	.084	.27	27	280+j600	38+j136	70+j136	20°	11°	30	7'	14'	1.240
Torque Receiver	CRC-8-A-1	26.0	.100	.50	37	—	—	11.8	200	—	—	—	12	54+j260	12+j45	85.1+j20.4	8°	—	30	30'	30'	1.240
Vector Resolver	CVC-8-A-1	1-26	.057	.34	78	—	—			11.8	.294		27	103+j444	28.8+j27.9		10.2°	—	1MV/V			1.240

TYPICAL SYSTEM MEASUREMENTS

SYSTEM	Input V400cy	Input Amps	Input Watts	Output Volts	Sensitivity (MV deg.)	CPPC TYPES	Input Z	Output Z	Phase Shift	Nulls (MV)	REMARKS
Transmitter→C.T.	26	.110	.74	23.6	408	CGC-8-A-7→CTC-8-A-4	58+j226	626+j233	19°+	50	Hi Z Load on CT
Transmitter→C.T.	26	.111	.75	23.3	407	CGC-8-A-7→CTC-8-A-4	58+j226		19°	50	50K Load on CT
Transmitter→C.T.	26	.111	.83	20.8	363	CGC-8-A-7→CTC-8-A-4	64+j221		17°	50	5K Load on CT
Transmitter→4 Parallel CT's	26	.145		21.8	381	CGC-8-A-7→4 CTC-8-A-4			28°	40	CT Interaction ½° Max.
Transmitter→Differential→C.T.	26	.134	1.78	19.5	340	CGC-8-A-7→CDC-8-A-1→CTC-8-A-4		748+j364	40°	40	CT Output to Hi Z
Series Vector→Electrical Resolver	1→26	103	67	4.9	85	CVC-8-A-1→CSC-8-A-1	55+j230	32+j68	32°	40	$E_o = .19\ E_i \sin\theta_1 \sin\theta_2$
Series Vector Resolvers	1→26	.110	.55	5.2	91	CVC-8-A-1→CVC-8-A-1			20.2°	40	$E_o = .2\ E_i \sin\theta_1 \sin\theta_2$
Transmitter→Receiver	26	.200	1.0	—	—	CGC-8-A-7→CRC-8-A-1			—	—	Torque 2400 mg mm/deg.

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How to Prepare Papers the Easy Way

(In a talk, "Skull-to-Skull Communication of Technical Ideas," given by Philip J. Klass, Avionics editor of Aviation Week, at the National Conference on Aeronautical Electronics at Dayton, Ohio, four simple principles were described for improving effectiveness of papers at technical meetings. Because many companies have asked to reproduce the paper for their staffs, AVIATION WEEK is publishing it.)

By Philip J. Klass

The time has come to do something about one of the brutal forms of torture devised by civilized man, the hundreds of technical talks delivered every year at dozens of technical conventions.

The amazing thing about these proceedings is that in a single year engineers will spend several million man-hours, or several thousand man-years, sitting and listening to technical talks.

If we are to make efficient use of our most critical natural resource—scientific manpower—there can be only one reason that justifies an engineer in taking the valuable time of hundreds of his colleagues. That is to transmit technical information into the heads of his audience.

Conversations with dozens of engineers on this problem, coupled with my own experience in sitting through several hundred technical talks every year leads to this conclusion: the efficiency of our skull-to-skull communication is far too low. No respecting engineer would turn out communications systems which had such poor information transmission capabilities.

We can greatly increase the efficiency of our skull-to-skull communications and simultaneously reduce the human torture that now accompanies technical talks if engineers will apply a few basic engineering principles to the preparation of their talks.

The first of these principles:

Determine Objective

Imagine a project engineer calling his group together and saying:

"Men, let's go into the lab and develop some new piece of equipment. Don't know whether it should be a radar, an autopilot, or a digital computer . . . but let's get started and we'll see what comes out."

Even with the present engineering shortage, he'd probably be fired.

If this project engineer announced that the objective of the new development was a new radar, would anyone even lift a finger before it had been determined whether the equipment was for land, ship, or airborne use, and whether the objective was to design a smaller set, one with greater range, or to meet some other specific requirement?

Yet, how many engineers will begin to write a technical paper, and even finish it, without ever asking themselves: "What is my objective?"

It is not sufficient that the prospective speaker determine that he is going to discuss the AN/APN-99 radar. His objective must be far more specific. For example, the speaker should first decide whether his primary objective is to:

- **Reveal** a new scientific discovery in radar propagation, or . . .
- **Describe** novel operational features of the new radar, or . . .
- **Describe** novel circuit design details, or . . .
- **Discuss** novel packaging techniques employed . . .

As bad as the speaker is who has no objective, equally dangerous is the speaker who has too many objectives. No one can work in any field for even a few weeks without accumulating more knowledge than he can disseminate in the 20 or 30 minutes normally allotted for a technical talk. The speaker who tries to tell everything he knows in 20 minutes usually runs out of time without getting across any of his ideas.

The second principle is:

Analyze Audience

Analyzing your audience consists of finding out what it is likely to know already about your subject matter, what it would like to learn and what it can most profitably use. When a prospective speaker fails to analyze his audience, he is likely to tumble into one to two pits:

- **He may waste** his precious few minutes, and the time of his audience, in discussing the obvious and well known, or . . .
- **He may quickly lose** his audience by jumping deeply into the subject, assuming that everyone else is an expert, too.

Suppose an engineer were going to give a talk before the Dayton Conference on Aeronautical Electronics. It would be safe to assume that most of the audience knows well the general problems that face designers of airborne avionics equipment—wide temperature ranges, extreme altitudes, and severe vibration and shock. Unless there is some unique environmental requirement which the equipment to be described had to meet, there is no need for the speaker to waste time by detailing environmental requirements.

On the other hand, if the talk were on the subject of the effects of nuclear radiation on electronic components, chances are that many of those who would attend this particular convention would be a bit hazy on the difference between beta and gamma radiation. Therefore, an anlysis of the audience would suggest that the speaker explain a few nuclear fundamentals early in his talk.

When a prospective speaker analyzes his audience, he should find out what has been written on his subject in the technical and trade press. The easiest way to do this is to ask the company librarian to make up a bibliography on the subject, then take time at least to scan the publications listed.

For example, take Tacan. I doubt whether there is any one in the avionics field who hasn't heard of Tacan, and most have a general idea as to what Tacan is and how it operates. Volumes have been written on subject in the aviation and electronics trade press. An engineer delivering a paper on a specific phase of Tacan equipment design can safely assume his audience needs no detailed introduction.

When the prospective speaker has determined his objective, and analyzed his audience, then—but only then—is he ready to start writing. Then he is ready for the third principle:

Capture Interest Quickly

Any speaker who thinks he has a captive audience is badly mistaken. There may be a few in the audience who are sitting on the edges of their chairs, waiting for pearls of wisdom to fall from the speaker's lips—but they will be very few in number. The others will be musing on the last speaker's talk, or the children's smallpox, or how the project is going back at the office, or whether an airplane reservation will come through.

These extraneous ideas, or "noise," are a challenge to the speaker to break through. Not only must the speaker capture attention and interest—he must do it quickly. Initial curiosity must be converted quickly into audience interest.

If we were to plot a curve of a typical technical talk it would look something

lick that at right. Here Interest is plotted the Y-axis as a function of Time (duration of the talk). Interest usually builds quite slowly, if at all. This is because the typical technical talk begins with dull preliminaries or a tedious history of the project. It is only about half way through that the usual speaker gives his audience the first glimmer into what is new, or how it can be put to use.

The interest curve for an ideal technical talk (right below) shows a burst of interest at the start of the talk, which continues to build as the talk progresses.

Any speaker can organize his talk to follow this curve if he will begin by telling his audience something new or novel. He can then build upon this initial interest by telling his listeners how they can apply it or benefit from it.

It is not sufficient to stick this information into a talk somewhere along the line. Within the first two minutes, the successful technical speaker should answer two questions for his audience:

- **What is novel or new?**
- **How can I apply it or benefit from it?**

For example, suppose that the subject of the talk is "A Semiconductor Capacitance Amplifier," and the objective is to inform the audience of the existence of this novel amplifier and arouse interest in applying it. The speaker might begin his talk this way:

"If you are now working with dielectric amplifiers, you'll want to investigate a new type which uses a simple junction diode, biased in the reverse direction. Compared to the familiar capacitance type dielectric amplifier, the new semi-conductor dielectric amplifier offers higher and more stable gain, and greater power handling capacity."

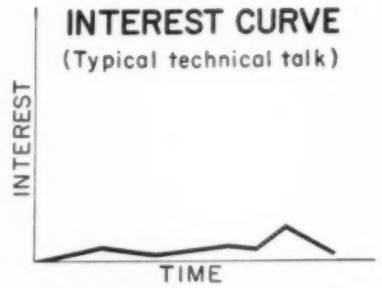
This should then be followed by a brief description of the type of applications where the new circuitry can be applied.

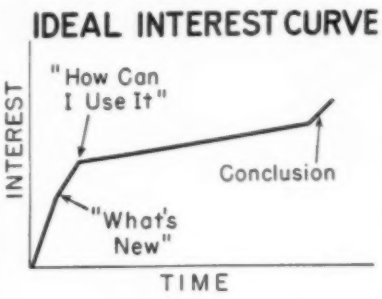
Once the speaker has whetted audience appetite, the listeners will be willing, even anxious, to plow through more difficult technical details of circuit parameters and design.

Not Original

The foregoing is not a novel idea. When technical papers are published, they usually are preceded by a brief abstract which gives the reader a preview of what's coming and what's new. This same general approach is used in newspaper and magazine articles. The first paragraph tries to arouse interest and simultaneously give a capsule summary of the whole story.

This does not mean that a technical talk should be preceded by a dry abstract. The speaker's opening words, like those of any professional writer, should be chosen carefully to challenge





the listener to stick in there for the next 20 minutes.

The fourth, and final, principle for improving the efficiency of our skull-to-skull communication of technical ideas is:

Match Audience Passband

When it comes to receiving technical information, the human mind has a much narrower passband for information obtained through the ears than through the eyes.

For example, when you read a technical paper you can set your own individual pace. If you come to a difficult part, you can pause, think it over, reread it.

But listening to a technical talk, you must proceed at the speaker's pace. If you pause to try to figure out his last statement, you miss what follows, and often lose the train of thought completely.

What does this mean to a technical speaker? If his talk involves any degree of technical sophistication, it means that he should write two versions of his paper—one for oral delivery, the other for publication.

The oral version should use simple, quickly understood words, and short sentences. In delivering the talk, the speaker should pause frequently, particularly after a tough passage, to give his listeners some thinking time—a few moments to grasp the meaning.

The Place for Math

The oral version must be particularly well organized. Every idea should logically lead to the one that follows, with suitable transitionary phrases to help the listener bridge the gap.

In the oral presentation, long mathematical derivations should be held to the barest minimum. After sitting through half a dozen technical talks in one morning or afternoon, even the brightest engineers have trouble whipping through a long exercise in higher mathematics.

The more detailed mathematical treatment belongs in the printed version. If the convention proceedings will not be published until some months later, the engineer should have his company mimeograph a few hundred copies of the written version. These can be placed at the back of the hall for those who are interested. More and more speakers are following this practice.

Use of Slides

One of the most important applications of this principle is in the preparation and use of slides.

How often have you seen a speaker flash a slide on the screen? Without giving the audience a split second to examine what has been plotted along the "X" and "Y" axes, he immediately points to a spot on the curves and says: "You'll note that for a flow of 4.65 lb. per minute, we get a tube temperature of 200 deg." Just about the time that the audience has succeeded in orienting itself as to what is plotted against what, the speaker signals for the next slide.

When a slide is first exposed, the speaker owes it to his audience to pause for a few moments. Then he should tell them what is plotted along the ordinate and abscissa, and give the units of measurement. If the slide has a family of curves, the second variable should be identified.

Only after the audience has been properly introduced to the slide, should the speaker proceed to point out the characteristics of interest.

Then there is the speaker who looks at his slide, finds that he's having trouble deciphering the small print, turns to his audience, and says: "I hope you all can make out the figures on my slide."

Curves and tabulations of data prepared for slides should differ sharply from those used in the published version.

The slides should contain only the barest details. Big, bold lettering should be used to label all information that is included.

The reason is that a slide seldom remains on the screen long enough for the audience to study its many implications.

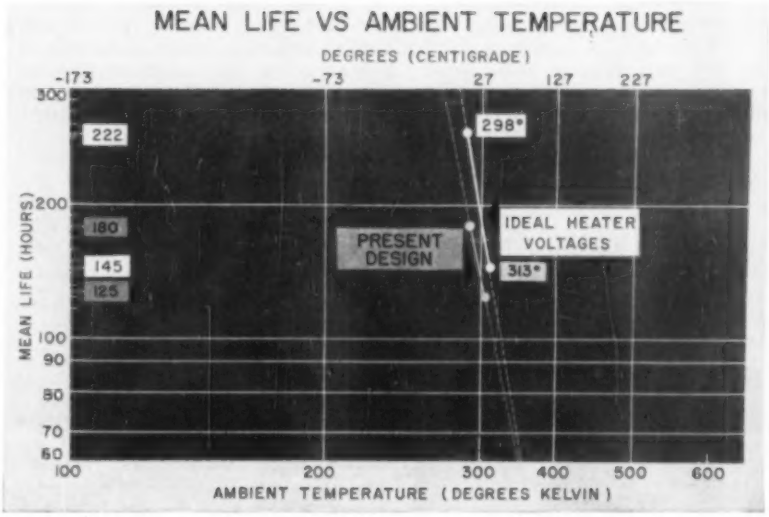
Even if it does remain on the screen for some time, the audience can not simultaneously study the curves and follow what the speaker is saying.

An example of a good set of curves

well-designed for slide use is shown. Here mean tube life is plotted in hours as a function of ambient temperature, both in degrees centigrade (along the top) and in degrees Kelvin (along the bottom). The curve on the left shows tube life in the present design of a certain equipment, the curve on the right tube life if equipment heater voltage were changed to the ideal value.

The operating temperature limits are clearly set out in the white blocks to save the audience from having to pick them off the X-axis. The range of mean life values are similarly shown on the left.

The original slide, prepared by an RCA engineer, was in color, a helpful addition to any slide. One color was used to show the characteristics of the present design, a different color to show the characteristics for ideal heater voltages.



Human Engineering Needed

In recent years, engineers have learned to apply principles of human engineering to the design of their equipment. Now it is time to apply the same kind of human engineering to the design of their technical talks.

The principles are easy:

- **Determine your objective.**
- **Analyze your audience.**
- **Capture audience interest quickly.**
- **Match the bandwidth of your talk to your audience's passband.**

There is one more axiomatic fundamental of good avionic design. Never drive your tubes or equipment far beyond the saturation point. This applies with equal validity to any technical speaker and his audience.

FILTER CENTER

▶ **Summer Computer Courses**—Wayne State University will hold three week-long courses, July 23 to Aug. 11, on:

- **Automatic computers,** their application and evaluation.
- **Electronic data processing** in business and government.
- **Application of computers** to engineering, science, and industry.

For additional information, write to A. W. Jacobson, Special Summer Program, Wayne University, Detroit 1, Mich.

▶ **ECM To Gentile**—Procurement of electronic countermeasures equipment will be handled by Dayton (Ohio) Air Force Depot, Gentile AF Station, effective July 1. The move is part of Air Materiel Command decentralization of procurement responsibilities. ECM contractors should address future inquiries to Gentile, attention MDPH.

▶ **Ingenious Recruiting**—Another novel approach to recruiting engineers was tried by Stromberg-Carlson during recent Dayton avionics conference. Complimentary newspapers slipped under hotel doors the first day carried a note reading: "Welcome to the Aeronautical Electronic Conference. Please accept this copy of the Dayton Journal Herald with our compliments. See our ad on page 8 for engineering opportunities."

▶ **Taxi Radar For Seattle-Tacoma**—British Decca Q-band airport surface detection radar is being installed at the Seattle-Tacoma International Airport, following technical evaluation tests at the Rome Air Development Center. Decca taxi radar was described in AVIATION WEEK, June 20, 1955, p. 51.

▶ **Add Another Inertial Guidance**—AVIATION WEEK's list of companies active in inertial guidance (Jan. 23, p. 79), since supplemented by reports from other firms active in the field, should include M. ten Bosch, Inc., Pleasantville, N. Y. Company says it is now completing a prototype inertial system under military sponsorship which it expects to "be remarkable for accuracy over long distances, general applicability and minimum complexity and size."

NEW AVIONIC PRODUCTS

Components & Devices

- **Sub-miniature RF switch,** for airborne radio and radar, available for frequencies up to X-band. Switches are available in SP4T, SP3T, SP2T, DP2T, DP3T models, fail safe or selective, require 0.1 amp maximum at 28 v.d.c. for operation. Units reportedly meet MIL-E-5272A environmental requirements, have excellent isolation, VSWR and insertion loss figures, according to

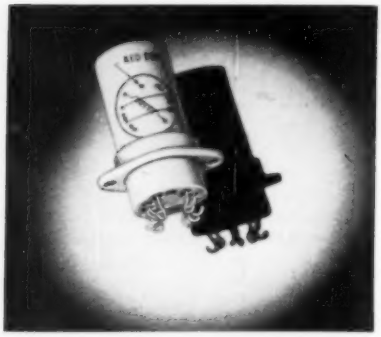
manufacturer. Electromation Co., Cado Div., 116 So. Hollywood Way, Burbank, Calif.

- **Hydrogen thyratron,** Model BL-257, is electrically similar to Model E37A but ruggedized for vibration and high impact service. Tube is rated for 5G from 60 to 500 cps, 3G from 500 to 1,200 cps, plus 60G impact. Operating temperature range is −50C to 90C, and altitude range is up to 10,000 ft. Peak anode voltage is 8 kv., with 100 ma maximum anode current. Bomac Laboratories, Inc., Salem Rd., Beverly, Mass.

- **Rate gyro,** Model 36129, oil-filled, has non-heated temperature sensitive mechanism for maintaining linear damping ratio over temperature range of −54C to 71C. Gyro is available with standard rates of from 15 to 200 deg./sec., and motor excitation of 115 or 200 v., three-phase, 400 cps. Gyro has precision pot pickoff which provides signals up to 70 v., with 1½% linearity or better. Unit comes in 2-in. diameter case. G. M. Giannini & Co., Inc., 918 East Green St., Pasadena 1, Calif.

• **Sub-miniature power supply,** for airborne use, provides 160 v.d.c. at 100 ma. and 6.3 v.a.c. at 5 amps, operates from 115 v.a.c. 400 cps power input. Unit has inherent regulation of 7½% from zero to full load. Power supply measures 1 x 3 x 9 in., weighs 2¼ lb. Land-Air, Inc., Instrument & Electronic Div., Oakland Airport, Oakland, Calif.

• **Sub-miniature a.c. relay,** Type HG-2SM-R, operates at frequencies ranging from d.c. up to 10 kc. Relay is available with operating voltages of 6 to 115 v.a.c. or d.c., operates up to 140C, has



contacts rated at 3 amps resistive, 1 amp inductive at 28 v.d.c. or 115 v.a.c. Relay measures ⅝ in. dia. x 1¼ in. long. Hi-G, Inc., Bradley Field, Windsor Locks, Conn.

• **Miniature tube shield liner,** for conducting bulb heat to tube shield and chassis, is made of beryllium copper to give it spring properties which can accommodate slight differences in bulb diameters and contours, yet maintain contact with tube shield. Liner is available in either black cadmium plate or Henderlube finish 402A. International Electronic Research Corp., 145 West Magnolia Blvd., Burbank, Calif.

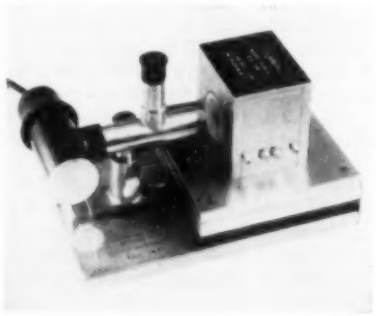
• **Sub-miniature tube socket-holder,** provides support for holding standard Eby or Cinch button or press-type tube sockets as well as tube itself. Atlas E-E Corp., Bedford Airport, Bedford, Mass.

Laboratory & Test Equipment

• **Low-frequency oscillator,** Model 202C, covers band of 1 cps to 100 kc. in five ranges. Unit delivers 160 mw., has accuracy of 2%, with frequency response flat with 1 db. over full range, less than ½% distortion above 5 cps. Hum voltage is less than 0.1% of rated output. Price: $300 f.o.b. factory. Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif.

• **Regulated d.c. power supply,** Model MR 532-15, has output range of 3 to 36 v.d.c. at 15 amps, with static regulation of ¼%, ripple less than mv., and dynamic regulation less than 1% for 10% line transient, less than 1.5 v. for 10% load transient. Response time is less than 25 ms. for line transients, 150 ms. for load transients. Unit operates from 80-150 v.a.c., 60 cps. Magnetic Research Corp., 200-202 Center St., El Segundo, Calif.

• **Interferometer,** Model AT-16, measures absolute displacements down to 4×10^{-6} in. Unit operates on Fabry-



Perot Principle, can measure displacements having frequencies in range of 500 to 25,000 cps, with accuracy of 6%. Gulton Manufacturing Corp., Metuchen, N. J.

Production, Field Testers

• **Portable junction transistor checker,** tests for collector leakage with grounded base, collector current at zero base current, and base-to-collector current gain. Device can check PNP or NPN types. Price: $31.50. Instant Circuits Div., of Alfred W. Barber Laboratories, 32-44 Francis Lewis Blvd., Flushing, N. Y.

• **Radio interference threshhold indicator, Type 91296-1,** for use with Stoddart Radio Interference field intensity measuring equipment over frequency range of 30 cps to 1,000 mc., will actuate warning light or bell when radio interference exceeds a pre-set level. Stoddart Aircraft Radio Co., Inc., 6644 Santa Monica Blvd., Hollywood 38, Calif.

• **Automatic capacitance bridge,** displays measurement instantaneously without balancing operations. Accuracy is within 0.1 mmfd. over entire range of 0 to 1,000 mmfd. Device is available for either 400 cps or 60 cps operation. Simmonds Aerocessories, Inc., 105 White Plains Rd., Tarrytown, N. Y.

Quick Decision

Douglas Aircraft Co. is using closed-circuit television to make quick, critical decisions on the acceptability of machined parts. When special consultation is required between the production liaison engineer and the design engineer who established the original specifications on the part, the TV installation is used to flash an enlarged image of the machined parts on a 21-in. screen in the engineering department, nearly a mile from the production floor. This allows the design engineer to make a quicker final determination of the acceptability of the part, minimizing production delays. C. J. Hertel, chief production liaison engineer, is seated in center.

New Avionic Literature

• **Memotron,** new 5-inch storage-type cathode ray tube which retains images until intentionally erased. Resolution 60 lines/in. Brightness: 50 ft.-lamberts. (Four pages) Hughes Products Div., Hughes Aircraft Co., Culver City, Calif.

• **Servo motors and generators,** Catalog No. 7, contains full application data. (16 pages). G-M Laboratories, Inc., 4300 No. Knox Ave., Chicago 41, Ill.

• **Electronic instruments, power supplies.** Short-form catalog "B". (Four pp.) Krohn-Hite Instrument Co., 580 Mass. Ave., Cambridge 39, Mass.

• **Solid tantalum capacitors,** Type STA. Bulletin 6.110. Fansteel Metallurgical Corp., Rectifier-Capacitor Div., North Chicago, Ill.

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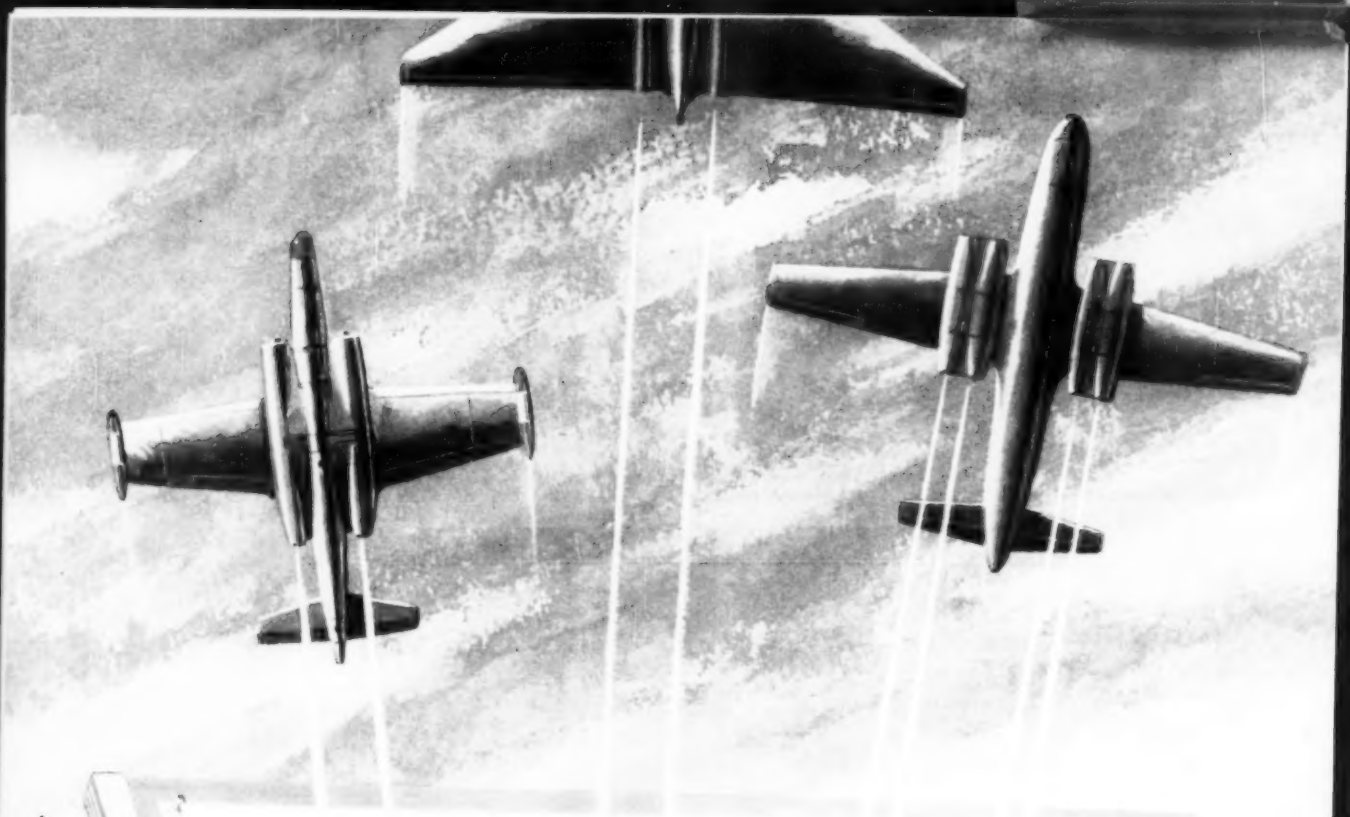

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USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

HEADQUARTERS, Wright-Patterson AFB, Ohio

American Machine & Foundry Co., Electronic Div., 1085 Commonwealth Ave., Boston 15, Mass., fire control system radar adapter kits, radar set adapter kits, spare parts, maintenance and engineering data, (PR PH228853, PH228854, PH236597 and PH236597-1), $208,000.

The Reflectone Corp., Post Road, Stamford, Conn., trainer, cockpit procedure, spare parts, special tools, engineering data (revisions), maintenance data (revisions), handbook of inspection requirements, engineering services, (PR235679-3), $181,648.

Sundstrand Aviation Div. of Sundstrand Machine Tool Co., Rockford, Ill., transmission St., Peekskill, N. Y., jet mixer—ea., (PR 235859-2), $797,109.

General Aniline & Film Corp., Ansco Div., Binghamton, N. Y., film, 16mm x 1200', MP, color duplicating, 480000 ft; film 16mm x 100', MP color, daylight type, 688 roll, (RFP 30-635-56-4471Q), $22,885.

Eastman Kodak Co., 343 State St., Rochester 4, N. Y., film 16mm x 1200', MP B&W, 1600000 ft; film, 35mm x 1000', B&W, positive, 1800000 ft; film, 35mm x 1000', safety print, 1300000 ft, (RFP 30-635-56-4468Q), $80,288.

HQ., SACRAMENTO AMA, McClellan AFB, McClellan, Calif.

Heller - Campbell - Erickson - Lawrence Constr. Co., (A Joint Venture), 4671-24th St. Rd., Sacramento, Cal., installation of acoustical treatment and installation of a freight elevator complete with controls in Bldg. 9 (P/R 5115), job, $45,800.

Now!... the NEW ROBINSON WIRE TWISTER with DIAGONAL GRIP-HEAD

Faster, more efficient than ever! The new, slendernose DIAGONAL GRIP-HEAD is designed especially for those narrow- hard-to-reach places. Split-second whirling action safety-wires 3 engines in time required for one by any other method . . . saves as much as $140 per engine assembled.

3-TOOLS-IN-1 . . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

12" —for assembly line safety wiring, 15 oz. **$21.50**

9" —for bench work, sub-assemblies, 12 oz. **$20.50**

Unconditional Money-Back Guarantee. Send for complete details.

RALPH C. ROBINSON CO.
Box 494W No. Sacramento 15, Calif.

Canadian Distributor, Gensales, Ltd., Malton, Ont.

HQ. OKLAHOMA CITY AMA, Tinker AFB, Okla.

MEMPHIS AF DEPOT, Mallory AF Station, 3300 Jackson Ave., Memphis 2, Tenn.

McNeese Construction Co., 690 Scott St., Memphis, Tenn., construction, IFB 40-604-56-148), 1 job, $85,000.

Allen Industrial Products, Inc., 97 Liberty St., Battle Creek, Mich., winterization kit, PR LP-ENG-56-9175, 15 ea., $38,820.

AVCO Mfg. Corp., Lycoming Div., Oliver St., Williamsport, Pa., spare parts, RFP 40-604-56-117, 8276, ea., $25,104.

Bell & Gossett Co., Marlow Pumps Div., Greenwood Ave., Midland Park, N. J., spare parts, RFP 40-604-56-127, 1499 ea., $39,-179.

SAN ANTONIO R&D Procurement Office, ARDC, P. O. Box 63, Lackland AFB, San Antonio, Tex.

Associates for International Research, Inc., 102 Mount Auburn St., Cambridge, Mass., research for evaluation of social systems, analysis, (Contract AF 41(657)-81), job, $36,787.

National Opinion Research Center, 5711 S. Woodlawn Ave., Chicago, Ill., research to determine community reaction to AF Noise, (Contract AF 41(657)-79), job, $62,-250.

University of Denver, University Park, Denver 10, Colo., research and development test of A course in basic principles of Cobplex equipment functioning, (Contract AF 41(657)-80), job, $36,470.

Lockheed Aircraft Corp., Georgia Div., 86 S. Cobb Drive, Marietta, Ga., development of prototype test equipment analysis, (Contract AF 41(657)-67), job, $53,604.

HQ. OGDEN AMA, Hill AFB, Utah.

Cruver Mfg. Co., 2460 W. Jackson Blvd., Chicago 12, Ill., model aircraft, 6000 ea., mold used for manufacture of model aircraft, 6 ea., (11 items, IFB 42-600-56-253), $39,595.

Smith Boiler Works, 545 Harrison Blvd., Ogden, Utah, replacement of boilers in bldg. No. S-878, (1 item, IFB 42-600-56-252), $45,902.

Electrol, Inc., 85 Grand St., Kingston, N. Y., 4642-400-61L strut assembly, 200 ea., 4642-400-61R strut assembly, 200 ea., (2 items, PR 00-497787), $795,600.

Gladden Products Corp., 635 W. Colorado St., Glendale 4, Cal., 4108-211543 valve hyd, 493 ea., 4108-311546 cylinder assy, 729 ea., 4108-411661 valve assy hyd 213 ea., 4108-111248 boot-rod, 311 ea., 4108-111553 stem-packing-piston, 1862 ea., 4108-11588 stop cylinder, 370 ea., 4100-111593 poppet cylinder, 175 ea., 4108-111841-7 washer key, 1556 ea., (8 items, PR 00-542952), $41,041.

BASE PROCUREMENT OFFICE Eglin AFB, Fla.

B. B. Saxon, Contractor, P. O. Box 683, Fort Walton Beach, Fla., construction of addition to building No. 142 Eglin AFB, Fla., (IFB 08-603-56-459), job, $25,800.

DEPARTMENT OF THE AIR FORCE, Hq. U.S.A.F. Academy, Construction Agency, P. O. Box 1670 Colorado Springs, Colo.

Burkhardt Steel Co., 869 S. Broadway Denver 9, Colo., furnishing, fabrication and erection of structural steel warehouse IEO shops and administration building and Auto Maintenance shops (IFB 05-613-56-13), job, $327,660.

T. F. Scholes Inc., 632 Washington St., P. O. Box 112, Reading, Pa., grading of cadet-academic area, parade & drill fields, grading and drainage of athletic fields and construction of retaining walls in cadet-academic area, (IFB 05-613-56-10), job, $2,373,586.

ARMED SERVICES Petroleum Purchasing Agency, Washington 25, D. C., April 13.

The following awards were issued under IFB 56-36(a):

International Lubricant Corp., P. O. Box 390, New Orleans, La., lubricating oil, 1353015 gals, $343,666.

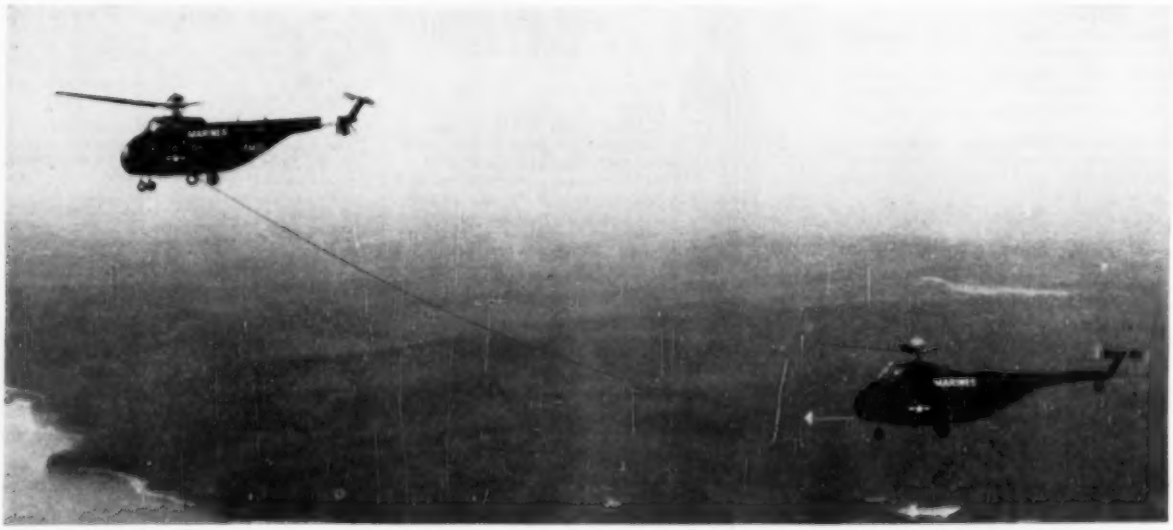
Atlas Lubricant Corp., P. O. Box 4095, New Orleans, La., lubricating oil, 100100 gals $27,778.

(*Continued on page* 77)

LARGE TANKER SYSTEM is one of three used by Navy. Two F2H fighters are fueling here from R3Y. Four can refuel simultaneously.

SUSTAINING TANKER, here carrier-based AJ/fueling FJ-4, is used to refuel defensive aircraft, in weather emergencies. Equipment is probe and drogue. Buddy is third system.

Navy Varies Fueling Types, Adds Helicopters



REFUELING OF HELICOPTERS was proven feasible in previous demonstration by Marine Experimental Helicopter One at the Quantico, Va., Marine Air Station. Probe-drogue system similar to those of tanker planes above is used, but transfer of fuel was simulated.

(Continued from page 75)

Sinclair Refining Co., 600 5th St., N. Y. 20, N. Y., lubricating oil, 500000 gals., $149,450.

Shell Oil Co., 50 W. 50th St., N. Y. 20, N. Y., fuel oil, (IFB 56-60), 1260000 gals., $67,500.

The following awards were issued under IFB 56-70:

Cato Oil & Grease Co., Inc., P. O. Box 1984, 1808 N. E. 9th St., Oklahoma City 1, Okla., lubricating oil, 143554 gals, grease, automotive, 1960 lbs., $100,532.

ARMED SERVICES PETROLEUM PURCHASING AGENCY:

Southwest Grease & Oil Co., Inc., 220 W. Waterman, Wichita 2, Kans., great automotive 1107475 lbs., grease, graphite, 2275 lbs, lubricating oil, 47460 lbs., lubricating oil, 192030 gals, $268,297.

Columbia Oil Co., Inc., 1419 Papin St., St. Louis, Mo., lubricating oil, 39357 gals, $27,469.

Standard Oil Co. of Calif., 225 Bush St., San Francisco 20, Cal., lubricating oil, 19077 gals, lubricating oil, 23635 lbs, grease, automotive, 318660 lbs, grease railway, 75000 lbs, $44,737.

Clearkin Chemical Co., American & Cumberland Sts., Philadelphia, Pa., corrosion preventive compound, IFB 56-76, 110140 gals, $88,112.

Kingston Chemical Co., Inc., 15 William St., N. Y. 5, N. Y., methyl-ethyl-ketone, 32175 gals, $29,343.

The Hancock Oil Co., 2828 Junipers Ave., P. O. Box 810, Long Beach 1, Cal., arctic diesel, IFB 56-78(a), 3360000 gals, $343,728.

Union Oil Co. of Calif., 617 W. 7th St., Los Angeles 17, Cal., arctic diesel, IFB 56-78(a), 10710000, $1,107,540.

Delhi Taylor Oil Corp., Poth Lane (P. O. Box 4067), Corpus Christi, Tex., aviation fuel, JP-5, (IFB 56-101), 2100000 gals, $189,000.

Link Aviation, Inc., Binghamton, N. Y., C-11C trainers, instrument flying, jet propelled aircraft for Air National Guard, MDAP and Department of Navy, C-11B trainers instrument flying, jet propelled MA-1 low frequency radio range attachments C-11B, spare parts, maintenance and engr. data and services by technical service representative, (PR PH-635521, PH-635523, PH-635523-1, PH-635524, PH-635524-1), $3,000,000.

Ryan Aeronautical Co., San Diego, Calif., Q-2A drones and spare parts 59 ea., (PR PH-142807), $300,000.

Cessna Aircraft Co., Wichita, Kans., T-37 Airplanes and engineering and handbook data, (PR PH-221634), $5,034,280.

Beach Aircraft Corp., Wichita 1, Kans., L-23 D Airplanes, spare parts, data, special tools and GHE for the Department of the Army, (MIPR-R-56-610-TC), $700,000.

MIDDLETOWN AMA, Olmsted AFB, Middletown, Pa.

General Electric Co., West Lynn, Mass., repair and overhaul of S/N 6119-8TJ49GAA power supply assy, 555 ea., $35,658, (PR MA(718733).

ROME AF DEPOT, Griffis AFB, Rome, N. Y.

Lockheed Aircraft Service Inc., 4207 Empire Ave., P.O. Box 48, Burbank, Calif., prototype installation of AN/APX-25 in one F94 A/B and one F-80 type aircraft and prototype installation of J-2 compass manual slaving panel in one F-80C type aircraft (2 each), (P/R's 295664, 665 and 666, Contract AF 04(606)-4117), $27,636.

BASE PROCUREMENT OFFICE, Eglin AFB, Fla.

Paul Smith Construction Co., Inc., P. O. Box 87, Pensacola, Fla., construction of range instrumented radar and theodolite system, (IFB 98-603-56-107), job, $119,250.

Smith Engineering and Construction Co., Inc., P. O. 1831, Pensacola, Fla., construction of extension to range 70, (IFB 98-603-56-207), job, $519,250.

Electronics Associates, Inc., Long Branch Ave., Long Branch, N. J., resolving computer 8 ea., hight data recorder, 8 ea.; plotting board, 2 ea.; power and amplifier rack, 8 ea.; switching center, 3 pea, (P/R 16C-55-110,202,203,204,205), $375,240.

OGDEN AMA, Hill AFB, Utah.

Guardite Corp., 9535 S. Cottage Grove Ave., Chicago 28, Ill., chamber, low pressure rectangular stationary 20 man capacity, 1 ea., (1 item, RFP 99-543361), $44,494.

Link Aviation, Inc., Nolan Road, Hillcrest, Binghamton, N. Y., (definitized letter contract, $1875500 Purchase Request 99-217196, reported 1 July 55), modification of flight simulator, (PR 00-217196, 00-217196-1, and 00-543382), $3,905,559.

DAYTON AF DEPOT, Gentile AF Station, Dayton 10, Ohio.

Microwave Associates, Inc., 22 Commungton St., Boston, Mass., tube-electron transmitting magnetron JAN type 2J42 a/w spec, MIL-E-1B dtd 2 May 52, Amdt No. 3 thereto dtd 12 Nov 53 and test limit sheet JAN 2J42 dtd 27 Sept 50, 6000 ea., (RFP-33-604-56-1687), $419,700.

Joseph Pollak Corp., 79-85 Freeport St., Dorchester 22, Mass., solenoid assy-3 push pull type Jos Pollak A-896RSAB, 600 ea., handbook data in a/w MOMII exhibit No. 1-5, 1 set, (RFP 33-604-56-1874), $105,900.

Dubrow Development Co., 235 Penn St., Burlington, N. J., signal generator TS-452/U in a/w spec MIL-S-4933 dtd 27 Oct 54, 125 ea; running spare parts, (equipment spares), 119 sets, Maintenance handbook data in a/w provisions of MCMTT exhibit No 1-16 "B", engrg. data in a/w provisions of table 250 Vandyke negatives,

Republic Bomb Trainer

Miniature bomb dispenser attached to wing of F-84F (top) has won Republic Aviation Corp., its first contact with Navy. Minibomb, which costs $20 and is used for training, is placed in dispenser by crank operated loader (bottom). Dispenser, for which contract totals $350,000, carries four bombs.

HERE'S THE POT THAT COULDN'T BE BUILT
NEW M10T
TIC
MANUFACTURER OF THE WORLD'S FINEST POTENTIOMETERS
PIONEER OF PRECISION WIRE-WOUND POTENTIOMETERS
FOREMOST IN THE DEVELOPMENT OF NEW DESIGNS
UNEQUALLED FOR PROMPT DELIVERY-PRODUCTION PROTOTYPE

Over two years ago TIC's design engineers undertook a supposedly impossible project — design of an ultra-precision potentiometer adaptable to mass production. Old techniques and designs were discarded . . . new methods and concepts were pioneered . . . advanced production methods were developed. And the result, the all-new 10-turn M10T with unmatched electrical accuracy and mechanical precision.

Custom design for precision computer, servomechanisms and electro-mechanical instrumentation service, the wound coil, multiturn M10T provides the extreme electrical accuracy and stability required by these systems. Winding techniques, specially developed for the M10T, make possible linearities of 0.025% and lower. Special resistance wire permits a ±1% accuracy of total resistance . . . high temperature stability with a 0.002% per degree C temperature coefficient of resistance. Wide temperature range (−55°C to +85°C) . . . high dielectric strength . . . low equivalent noise resistance . . . and high leakage resistance are other M10T features in-built for maximum electrical performance.

Extremely precise mechanical tolerances — shaft diameter, concentricity, and perpendicularity — assure complete transfer of M10T accuracy to external systems. Universal mounting surface offers choice of servo or precision-pilot and tapped-hole mounting. Spring loaded, stainless steel ball bearings eliminate radial and end play of the shaft . . . reduce running torque to 1.0 oz.-in.

New design concept places all functional parts of M10T in a one-piece unit. Stainless steel cover bonded to the one-piece base provides complete environmental protection. External surfaces are all corrosion-resistant stainless steel or anodized aluminum. The M10T has been thoroughly tested to pertinent military specifications.

Complete specifications on the new TIC Type M10T are available upon request.

TECHNOLOGY INSTRUMENT CORP.

543 Main Street, Acton, Mass. COlonial 3-7711
West Coast Mail Address Box 3941, No. Hollywood, Calif. POplar 5-8620

1 set, blueline prints, 6 sets. (RFP 33-604-56-1899 and Amend No 1), $63,969.

MOBILE AMA, Brookley AFB, Alabama.

Bendix Aviation Corp., Utica Div., Utica, N. Y., repair and modification of Bendix 36E26 starters, (Contract AF01 (601)19617 Class 03J), 477, $271,952.

Bendix Aviation Corp., Utica Div., Utica, N. Y., repair and modification of Model 36E23 starters, (Contract AF01(601)19792 Class 03J), 263, $116,269.

United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn., overhaul and modification of type PS-500 aircraft, (Contract AF01(601)19193), 91, $40,940.

Atlanta Paper Co., 950 W. Marietta St., N.W., Atlanta, Ga., purchase of fireboard boxes, various sizes, (Contract AF 01 (601) 19803), 1656000, $32,329.

Taffet Radio & Television Co., 2530 Belmont Ave., Bronx 58, N.Y., C-996A/ARN-14 radio receiver set, 1035 ea., C-996A/ARN-14 radio receiver set, 999 ea., lubrication data, 1 set, engineering data, 1 set, (PR 168012 and 168012-1), $78,588.

Graflex, Inc., 154 Clarissa St., Rochester, N.Y., 0-24 identification camera, 24 ea., speed graphic camera sets, 2000 ea., cut film holders, 5440 ea., (MIPR R56-51-23375 G/6), $117,144.

Allison Div., General Motors Corp., Indianapolis 6, Ind., modification on government-owned gearboxes and procurement of technical publications, (PR 6819 and 6821), $249,139.

Red Bank Div., Bendix Aviation Corp., Eatontown, N.J., inverters, 50 VA, 3 phase, 168 ea., inverters, 500 VA, 3 phase, 112 ea., inverters, 500 VA, 3 phase, 288 ea., (PR 672755), $303,491.

Continental Aviation Engineering Corp., 12700 Kercheval Ave., Detroit, Mich., J-69-T-19A engines, (PR 708845), $1,360,592.

Ford Motor Co., Detroit, Mich., acquisition and installation of facilities, (PR 636-453), $9,380,000.

Ford Motor Co., Dearborn, Mich., construction of 4 est cells and acquisition and installation of related equipment, (PR 708-740), $2,563,757.

General Dynamics Corp., Convair, Fort Worth, Tex., facilities in support of production of B-58 aircraft and B-52 components, (PR 669565 and 669556), $4,016,000.

The Glenn L. Martin Co., Baltimore, Md., facilities for flight-testing of guided missiles, (PR PH-143540), $30,000.

Massachusetts Institute of Technology, Cambridge 39, Mass., facilities in support of the WS-107A program, (PR 669570), $290,000.

General Electric Co., Syracuse, N.Y., facilities in support of missile guidance system development, (PR 669566), $193,200.

General Electric Co., Syracuse, N.Y., design and engineering of additional facilities in support of the WS-107A program, (PR 669601), $60,000.

Solar Aircraft Co., San Diego, Calif., acquisition, manufacture, design and construction of facilities, (PR 669670), $232,000.

Boeing Airplane Co., Wichita, Kans., procurement of B-47E trainers and transparencies, (PR PH 143348), $60,178.

DAYTON AF DEPOT, Gentile AF Station, Dayton 10, Ohio.

Frebank Co., 6441 San Fernando Rd., Glendale 1, Cal., switch-press SPST Frebank Co P/N 2050-2A, 1400 ea., (RFP 33-604-56-2638), $42,462.

Culter-Hanner, Inc., 410 W. First St., Dayton 10, Ohio, 42 items of var quantities for toggle switches, (IFB 33-604-56-21), $292,088.

Phaostron Instr. & Electronic Co., 151 Pasadena Ave., S. Pasadena, Cal., multimeters TS-352B/U in a/w Mil spec MIL-M-4269A dtd 23 June 55, 1635 ea., revisions to engrg data in a/w table 250 and shipping instructions No 3, maintenance data (Rev.), (RFP 33-604-56-1876), $108,335.

Mechanical Products Inc., 1824 River St., Jackson, Mich., 3 items of var quantities for circuit breakers a/w spec MIL-C-7079, dwg AN-3160-PHO, dwg AN-3161-P-25 and dwg AN-3161-P-35, (IFB 33-604-56-23), $153,725.

Waltham Horological Corp., 711 Broad St., Lynn, Mass., connector-plug UG-495-B/U in a/w navy dwg RE49D536, 20000 ea., (RFP 33-604-56-1729), $43,400.

General Electric Co., Bloomington, Ill., solenoid intermittant oper: GE dwg No M7481001 P2 PF411/CPS-6B, 206 ea., solenoid, pull type GE P/N CR9503-211B, Cat #8668878AB2, 700 ea., (RFP 33-604-56-1846), $33,094.

Standard Electrical Products Co., 2240 E. Third St., Dayton 3, Ohio, resistors Jan-R-94 type RV4ATRK503A, 13000 ea., resistors Jan-R-94 type RV4ATRK254A, 12000 ea., resistor Jan-R-94 type RV4ATRK105A, 6000 ea., (IFB 33-604-56-80), $30,460.

Jackson Electrical Instrument Co., 18 S. Pattersen Blvd., Dayton 2, Ohio, 9 items of misc parts for repair and overhaul of various types of test equipment for electrical and electronic equipment var quantities, $36,539.

Omite Mfg. Co., 3601 Howard St., Skokie, Ill., 157 items resistors var quantities a/w spec MIL-R-26-B, (IFB 33-604-56-37), $57,571.

Fairchild Camera & Instrument Corp., Fairchild Controls Corp., Subsidiary, 225 Park Ave., Hicksville, L.I., N.Y., resistors var WW in a/w of rev H of sperry dwg No 824321, 2100 ea., (RFP 33-604-56-1141), $32,025.

A. R. F. Products, Inc., 7627 Lake St., River Forest, Ill., pulse generator set AN/UPM-15 in a/w MIL-P-6324A (USAF), 365 ea., data and drawings, (RFP 33-604-56-1477), $119,065.

SACRAMENTO AMA, McClellan AFB, McClellan, Cal.

North American Aviation, Inc., P.O. Box 95, Fresno, Cal., IRAN and modification of 185 F-86A/E type aircraft, (PR 537206-1, -2, -3, -4, -5, -6), job, $178,080.

Wolverine Diesel Power Co., 12700 Mansfield, Detroit 27, Mich., aspirator assy, P/N 8211-546-114 (245 ea), battery box steel, P/N 8211-546-120 (46 ea), battery box steel, P/N 8211-546-121 (46 ea), (PR 5221), $70,260.

North American Aviation, Inc., P.O. Box 95, Fresno, Cal., modification of thirty-six (36) F-86D type aircraft to TF 86D "chase" aircraft, (PR 340), job, $55,259.

BASE PROCUREMENT OFFICE, Eglin AFB, Fla.

Ampatco Laboratories Corp., 2700 E. 79th Street, Cleveland 4, Ohio, tester gyro, (IFB 98-603-56-374, PR 17C-LP-56-529), 1 ea., $30,600.

HQ. MIDDLETOWN AMA, Olmsted AFB, Middletown, Pa.

West-Hem Corp., 3601 S. W. 8th St., Miami 35, Fla., cylinder machining and studding assemblies, 229 ea., (RFP PR 662698), $18,778.

American Air Motive Corp., P. O. Box 6, Miami Springs, Fla., cylinder machining and studding assemblies, 3096 ea., (RFP PR 662698), $253,450.

HOLLOMAN AIR DEVELOPMENT CENTER, Holloman AFB, N. Mex.

Goodyear Aircraft, 1210 Massillion Rd., Akron, Ohio, test bench analog computer (IFB AF29-(600)-840), job, $32,000.

Aerojet-General, 6352 N. Irwindale Avenue, Azusa, Calif., F-M-FS smoke generator systems, (IFB AF29 (600)-855), job, $69,559.

MEMPHIS AF DEPOT, Mallory AF Station, 3300 Jackson Ave., Memphis 2, Tenn.

General Motors Corp., New Departure Div., Bristol, Conn., bearings, Contract No. (AF 40(604)6336), 20000 ea., $78,800.

Welded Construction Engineering Co., 2037 W. 14th St., Cleveland, Ohio, trailer, RFP 40-604-56-90, 116 ea., $35,960.

PURCHASING & CONTRACTING OFFICE, Building T-221, Langley AFB, Va.

Craig Systems, Inc., Danvers, Mass., units, communication, hut, helicop. class signal, (NEG. CONTRACT AF 44(600)-846), Total Amount $74,754.

HEADQUARTERS, SHELBY AF DEPOT, Wilkins AF Station, Shelby, Ohio.

American Cord & Webbing Co., Inc., 374 Broadway, N. Y., 13, N. Y., webbing, 45900 yd., $34,379, 100 yd-$100, 3000 yd, $750, (IFB 33-602-56-105), Total, $35,229.

Hood Rubber Co., A Div. of the B. F. Goodrich Co., 36 Nichols Ave., Watertown, Mass., boot, flying man's, rubber, black upper, rubber, non-skid sole, rubber, non-skid heel, laces up front; spec MIL-13-6481A, (USAF) dtd 29 Feb 52 and Amend No. 1 dtd 24 Sep 53, type A-17, 12764 pr, (RFP 33-602-56-3017), $100,452.

O. E. Szekely and Associates, Inc., P. O. Box 269, Commerce, Ga., trailer, lift bomb, type MF-1 mech. type welded steel frame equipped with drawbar, 261 ea., $343,186, technical data, 1 set, $1,500, (RFP 33-602-56-3005), Total $344,686.

HEADQUARTERS, Mobile AMA, Brookley, AFB, Ala.

Hayes Aircraft Corp., Birmingham, Ala., processing and maintaining limited extended storage of crated F-86-A type aircraft, (Contract AF 01(601)19813 Class 01M), 1 item, 54 aircraft, $57,507.

Baisley & Chandler, P. O. Box 1193, Mobile, Ala., erection of storage bins, (Government-furnished), project MOS, (Contract AF 01(601)19712), job, $49,674.

Grumman Aircraft Engineering Corp., Bethpage, N. Y., prototype of 1 each SA-16A aircraft to SA-16B configuration, (Contract AF 01(601)19527 Class 01A-SA-16A), 1, $800,200.

HEADQUARTERS, Dayton AF Depot, Gentile AF Station, Dayton 10, Ohio.

Western Electric Co., 195 Broadway, N. Y. 7, N. Y., 21 items of var quantities for dials, knobs, transformers and terminal boards, $28,293.

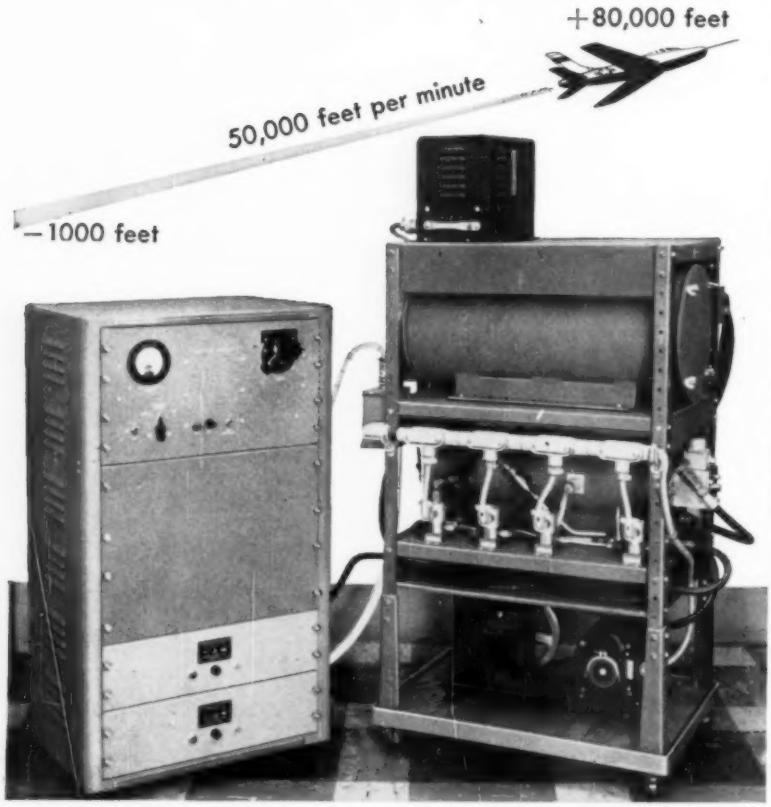
Hughes Tool Co., Hughes Aircraft Co. Div., Florence Ave. and Teale St., Culver City, Cal., 7 items of var quantities for adapters, ovens, harness, publications, drawings and design data in a/w Hughes Aircraft Co., P/N 404014-100 and 404198-100, $81,920.

Piqua Engineering Inc., South & College Sts. Piqua, Ohio, Relay-Assemblies AN-3025-1 in a/w MIL-C-5026-A, 2412 ea., (RFP 33-604-56-2172), $41,344.

Minneapolis-Honeywell Regulator Co., 2600 Ridgeway Rd., Minneapolis 23, Minn.,

DYNAMIC ALTITUDE SIMULATOR

New!



Duplicating the altitude conditions of high performance aircraft and missiles, the hydraulically actuated CTI Dynamic Altitude Simulator makes possible laboratory evaluation of flight control equipment and instruments without the expense and delay involved in actual flight test. Capable of control by an analog computer, the unit reproduces pressure variations along a computed flight path.

SPECIFICATIONS

	PRESSURE*	ALTITUDE
Setting Range	15.23 to 0.403 psia	−1000 to +80,000 feet
Bandwidth	± 0.35 psi	± 700 feet
Threshold	0.0005 psi	1 foot
Rate of Change, Max.	25 psi per minute	50,000 feet per minute
Threshold Rate of Change	0.0125 psi per minute	25 feet per minute

*At sea level (14.69 psia) with 100 cubic inches in unit under test. A smaller volume results in greater bandwidth and maximum rate of change.

Frequency response, at sea level, cps	10
Test chamber dimensions	9-in. diameter by 24-in. long
Input power	220 v, 3 phase, 60 cps, 1 ½ hp 115 volt, 60 cps, 750 watts

ALSO AVAILABLE: THREE-AXIS FLIGHT SIMULATOR

Write for complete technical data on the above equipments.

CTI®

COLOR TELEVISION INCORPORATED

SAN CARLOS 6, CALIFORNIA

VISIT BOOTH NO. 1065 AT WESCON, LOS ANGELES

tubes, electron receiving triode type 2C-52 a/w Spec MIL-E-1B dtd 2 May 52 Amdt No. 3 thereto dtd 12 Nov 53, supp. No. 12 thereto dtd 23 Aug 55 and individual Spec sheet MIL-E-1/31B dtd 22 Jan 54, 8500 ea., (RFP 33-604-56-1840), $136,170.

Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn., switches-fuel level revere P/N F5591, 1236 ea., (RFP 33-604-56-1905), $29,046.

HEADQUARTERS, Middleton AMA, Olmsted AFB, Middletown, Pa.

Avien, Inc., 58-15 Northern Blvd., Woodside 77, N. Y., indicators, fuel quantity & liquid quantity, 863 ea., (RFP PR MA-598781, PR MA-662500), $157,635.

The Cal-Tex Co., P. O. Box 266, Tyler, Tex., container, kit assembly, aerial delivery 413 ea., (IFB PR MA-662705), $35,418.

Frank B. Cross Jr. DBA Weezel Bait Co., 3506 Columbia Parkway, Cincinnati 26, Ohio, kit, fishing, survival, 18453 ea., (IFB PR MA-598791), $63,293.

Mills Mfg. Corp., P. O. Box 8068, Asheville, N. C., canopy, personnel parachute, 1456 ea., (IFB PR MA-598705), $130,748.

HEADQUARTERS, 3625th Combat Crew Training Wing, (Interceptor) office of the Purchasing & Contracting Officer, Tyndall AFB, Fla.

Smith's Inc., 709 North Oates St., Dothan, Ala., construction of AN/GPA-27; AN-FPS-3 radar building, (IFB 08-601-56-40), job, $38,873.

AIR FORCE MISSILE TEST CENTER, Patrick AFB ARDC, Fla.

Bendix Aviation Corp., Pacific Div., 11600 Sherman Way, N. Hollywood, Cal., addition of one telemetry Van and associated spare parts; and engineering services, (PR NO. FP-1(56)-361), job, $231,340.

AF OFFICE OF SCIENTIFIC RESEARCH, ARDC, P. O. Box 1395, Baltimore 3, Md.

North American Aviation, Inc., Atomics International Div., P. O. Box 309, Canoga Park, Cal., research—study relating to the use of beryllium oxide in nuclear reactors, (AF 18(600)-1596), job, $113,986.

The Regents of the University of Colorado, Boulder, Colo., research thermochemical studies of organic halogen compounds, (AF 18(600)-1151), job, $60,544.

Carnegie Institute of Technology, Pittsburgh 13, Pa., research—continuation of research on conformal and variational methods, (AF 18(600)-1138), job, $40,502.

Technical Operations, Inc., 6 Schouler Court, Arlington 74, Mass., research—fluorescence in phosphors, (AF 18 (600)-1134), job, $45,874.

The Institute for Advanced Study, Princeton, N. J., research—study of singular quadratic functionals, (AF 18(600)-1109), job, $81,250.

Rensselaer Polytechnic Institute, Troy, N. Y., research—method and apparatus for inducing fluid flow, (AF 18 (603)-37), job, $26,170.

Western Reserve University, 10940 Euclid Ave., Cleveland, Ohio, research—orbital electron capture by nuclei, (AF 18(603)-61), job, $25,171.

HEADQUARTERS, ROME AF DEPOT, Griffiss AFB, Rome, N. Y.

Gilfillan Bros, Inc., 1815 Venice Blvd., Los Angeles 6, Cal., waveguide assembly AN/MPN-1, 36 ea; RF Transmission line AN/MPN-1, 11 ea; RF transmission line AN/MPN-1, 18 ea., (RFP 30-635-56-4260Q), $30,478.

The Okonite Co., Passaic, N. J., cablepower elec 2 conduc 4 AWG, 7500 ft; cablepower elec 4 conduc 1 AWG, 6000 ft; cablepower elec 4 conduc 4 AWG, 24500 ft, (RFP 30-635-56-4092Q), $80,486.

Cornish Wire Co., Inc., 50 Church St., N. Y., N. Y., cable-assy 60 ft, 400 cyc, 4 ph, AC, IAW 24208, Spec MIL-C-7974 (IFB 30-635-56-184B), 1046 ea., $70,295

OFFICE OF SCIENTIFIC RESEARCH ARDC, P.O. Box 1395, Baltimore 3, Md.

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Professional Staff Appointments

The Johns Hopkins University Applied Physics Laboratory

8615 Georgia Avenue,
Silver Spring, Md.

Md., research, panel flutter investigation, (AF 18(603)-76), job, $35,941.

Armour Research Foundation of Illinois Institute of Technology, Technology Center, Chicago 16, Ill., research, investigation of electromagnetic launcher for high speed projectiles, (AF 18(603)-56), job, $41,439.

Corvey Engineering Co., 2610 Jefferson Davis Highway, Alexandria, Va., research, analytical studies, (AF18(600)-1130), job, $41,615.

Yale University, New Haven, Conn., research, differential equations of diffusion and dynamic systems, (AF18(600)-1127), job, $28,800.

The Regents of the University of Michigan, Ann Arbor, Mich., research, factors controlling nonlinear phenomena in ferromagnetic and ferroelectric ceramics, (AF18-(600)-8), job, $60,000.

Polytechnic Institute of Brooklyn, Brooklyn, N. Y., research, continuation of research of a high temperature crystal study, (AF18(600)-1193), job, $36,350.

The Board of Trustees of the University of Illinois, Urbana, Ill., research, the study of surface physics with radioactive substances, (AF18(603)-49), job, $26,984.

Mount Zion Hospital, 1600 Divisadero St., San Francisco 15, Calif., research, factors controlling excitation and neural activity in the human cerebral cortex and their relationships to conscious and behavioral activity, (AF18(603)-48), job, $51,845.

Bulova Research and Development Laboratories, Inc., 62-10 Woodside Ave., Woodside, N. Y., research, study on high speed camera, (AF18(600)-1606), job, $27,430.

Cornell University, Ithaca, N. Y., research, practical problems in aerodynamics, (AF 18(600)-1523), job, $59,086.

MOBILE AMA, Brookley AFB, Ala.

Textron American, Inc., M. B. Manufacturing Co. Div., 1060 State St., New Haven 11, Conn., refabrication of 6550 core assemblies, (Contract 01(601)19676 Class 03-J), 5, $95,122.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

NAVY DEPARTMENT, Bureau of Ordnance, Washington 25, D. C.

S. Gunner Myrbeck & Co., Quincy, Mass., develop and prepare manuscript outline and illustration schedules for submarine torpedo tubes, NOrd-16809, $45,950.

Vitro Corp. of America, Silver Spring, Md., engineering and field services in connection with torpedo MK 39 Mod 1 experimental production and evaluation program, NOrd-16816, $204,362.

Radio Corp. of America, Camden, N. J., studies, ordalts and new components to improve performance of designation equipment Mk6, NOrd-16932, $106,551.

Librascope, Inc., Glendale, Cal., design, develop, fabricate and deliver 1 prototype underwater battery control system EX-2, NOrd-16843, $130,000.

Farnsworth Electronics Co., Fort Wayne, Ind., fabricate, test and deliver EX 2 mod 0 Fuzes, NOrd-16886, IFB-Rel-97-56, 49, $249,900.

Yardney Electric Corp., N. Y., N. Y., 600 torpedo batteries Mk 52 Mod 0, 520 torpedo batteries MK 41 Mod 1, NOrd 16930, IFB Neg-Mag-13/56, $856,240.

Weston Electric Instrument Corp., Newark, N. J., sensitrol relays SR-5, BuOrd Dwg 1246130 NOrd-16962, (IFB Neg.Ma7-56/86), 500, $25,845.

Ekco Products Co., Chicago, Ill., rework 450000 3"/50 cartridge cases Mk 9 BuOrd 16982, (IFB Neg-Ma3A-3-10-56), $751,500.

Seth Thomas Clocks, Div., of General Time Corp., Thomaston, Conn., manufacture 250 evaluation models of actuation counter XE-3A, NOrd-16948, $188,611.

International Business Machines Corp., N. Y., N. Y., engineering services in connection with maintenance of the NORC, NOrd-16955, $62,702.

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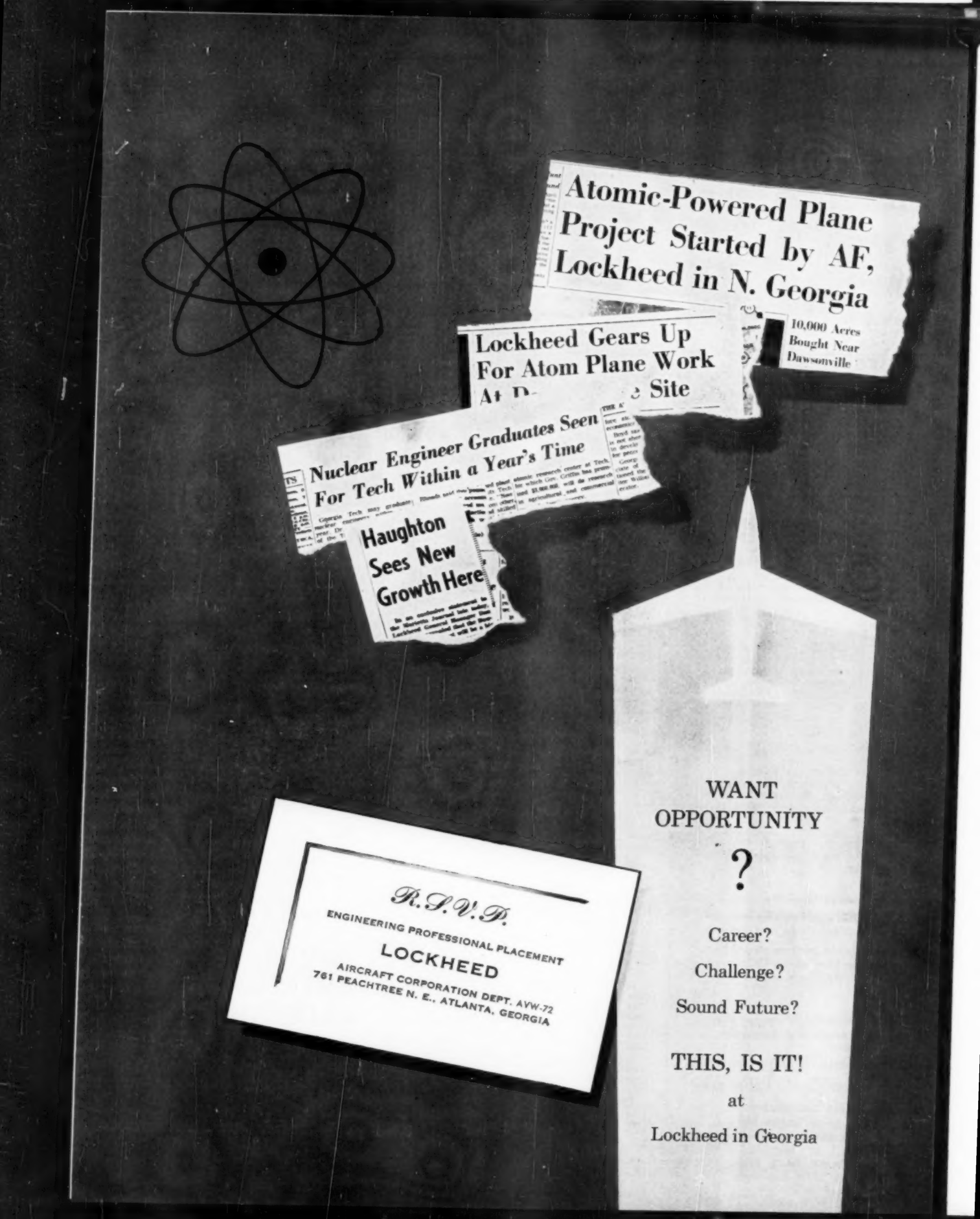
Atomic-Powered Plane Project Started by AF, Lockheed in N. Georgia
10,000 Acres Bought Near Dawsonville
Lockheed Gears Up For Atom Plane Work
Nuclear Engineer Graduates Seen For Tech Within a Year's Time
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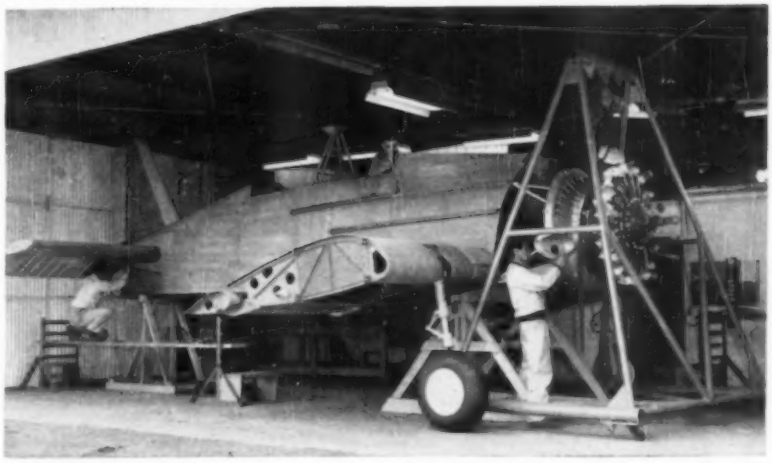
Ag-2 Plane-Spray Package Nears Test

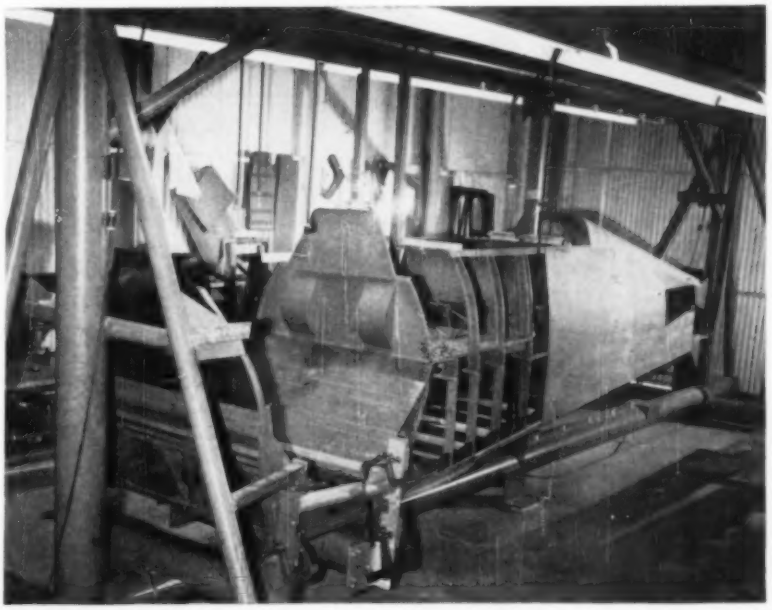
By Bernie Lang

Torrance, Calif.—Transland Co. plans an extensive flight evaluation program on its Ag-2 aerial application system comprising an airplane specifically designed for agricultural operation and a custom-designed spray/dust system. First flight of the prototype Ag-2 was scheduled for last week. A production model will join it soon to speed up the test program.

The initial Ag-2 is stripped of all dust/liquid-spray gear for a clean evaluation of the new plane's flight characteristics: Airplane No. 2 will have the new Transland-designed aerial application system. The all-purpose, high-density dust/liquid spray systems can be used, according to Transland, for any agricultural problem anywhere in the world.



CENTER wing section of Ag-2 carries four of the six 62.5-gal. tanks for spray system. Transland has rented new factory space since picture was made.



SOLIDS system includes a 53 cu. ft. hopper as an integral part of the fuselage aft of the engine firewall to the cockpit. Rotary gate dispenser is below.

Best Features of AG-1

Another function of the flight tests will be to evaluate all data the company has received from various agricultural research stations with respect to optimum patterns and spray distribution.

Transland designed the Ag-2 as an agricultural tool, incorporating the best features of the experimental Weick Ag-1, first airplane planned specifically for agricultural use (AW Sept. 13, 1954, p. 21). Five Ag-2s are on the production line. Completely equipped with the dust/spray systems, the airplane will list in the U.S. for approximately $25,000.

Models minus equipment also will be available.

The airplane will normally carry a payload of 250 gal. of liquid or 2,000 lb. of dust or other solid material. The applicating equipment includes a hopper, agitator, gate, spreader, tanks, engine-driven pump, valve and spray boom incorporating the best features of the company's three field-proven systems of dust equipment and high and low liquid spray systems.

Chemical Systems

The dust/liquid-spray equiment features:

• **Over-all performance** tailored for maximum efficiency in spraying or dusting with insecticides, fungicides and herbicides, distribution of chemical fertilizers, seeding. It can be used in the treatment of infested forests, the restoration of range lands through the application of top dressing, weed and insect control and defoliation.

• **Separate dispensing systems** for solids and liquids. By simple valving, an operator can change from dust to spray in a matter of seconds.

Mockup Built

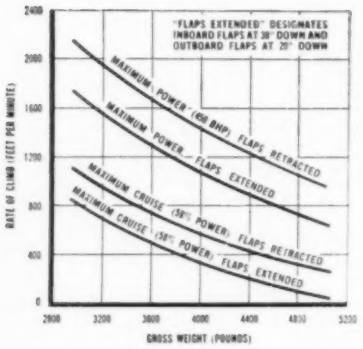
The system is capable of dispensing solids and liquids simultaneously. Operators can, in effect, put "dew" on foliage in the form of a liquid chemical or oil to assist the dust in adhering.

The solids system comprises a 53-cu.-ft. hopper, is an integral part of the fuselage aft of the engine firewall to the cockpit. Distribution of dust is controlled by a rotary gate and adjustable vanes located on the underside of the fuselage.

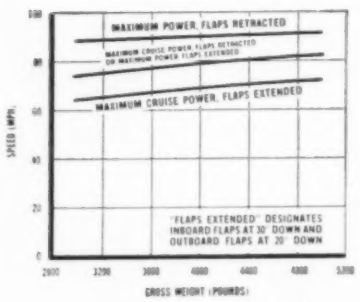
To evaluate the spray equipment, Transland designed and built a $10,000 static test bed in which extensive tests of pumps, valves, nozzles, were made.

Maximum values with respect to

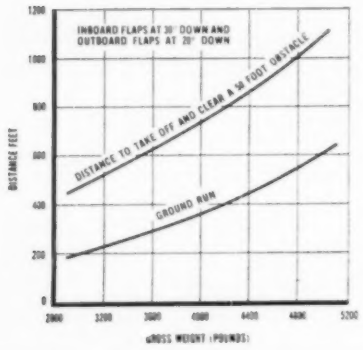
RATE OF CLIMB AT SEA LEVEL


"FLAPS EXTENDED" DESIGNATES INBOARD FLAPS AT 30° DOWN AND OUTBOARD FLAPS AT 20° DOWN
MAXIMUM POWER (650 BHP), FLAPS RETRACTED
MAXIMUM POWER—FLAPS EXTENDED
MAXIMUM CRUISE (50% POWER), FLAPS RETRACTED
MAXIMUM CRUISE (50% POWER)—FLAPS EXTENDED
RATE OF CLIMB (FEET PER MINUTE)
GROSS WEIGHT (POUNDS)

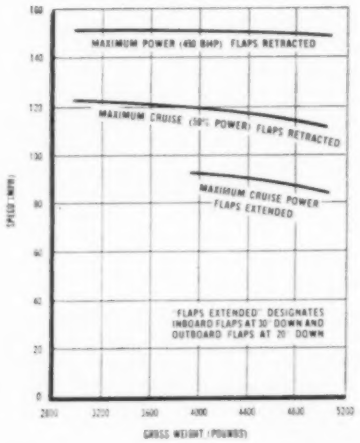
SPEED FOR BEST CLIMB AT SEA LEVEL


MAXIMUM POWER, FLAPS RETRACTED
MAXIMUM CRUISE POWER, FLAPS EXTENDED
"FLAPS EXTENDED" DESIGNATES INBOARD FLAPS AT 30° DOWN AND OUTBOARD FLAPS AT 20° DOWN
SPEED (MPH)
GROSS WEIGHT (POUNDS)

TAKE-OFF DISTANCE—SEA LEVEL—STANDARD DAY


INBOARD FLAPS AT 30° DOWN AND OUTBOARD FLAPS AT 20° DOWN
DISTANCE TO TAKE OFF AND CLEAR A 50 FOOT OBSTACLE
GROUND RUN
DISTANCE FEET
GROSS WEIGHT (POUNDS)

SPEED AT SEA LEVEL


MAXIMUM POWER (650 BHP) FLAPS RETRACTED
MAXIMUM CRUISE (50% POWER) FLAPS RETRACTED
MAXIMUM CRUISE POWER—FLAPS EXTENDED
"FLAPS EXTENDED" DESIGNATES INBOARD FLAPS AT 30° DOWN AND OUTBOARD FLAPS AT 20° DOWN
SPEED (MPH)
GROSS WEIGHT (POUNDS)

pipe diameter, length and bend were also determined.

The company reports that until now, information on tests of this type has never been available. Static tests consisted of a part-by-part analysis. Results of the over-all spray system will have to await flight tests.

As an example of a static test, Transland ran experiments on all applicable pumps available, designing several itself, to come up with an efficient high-density 21-lb. centrifugal engine-driven unit. Capable of delivery rates up to 240 gal. per min., it features no lubrication bearings.

The spray system can carry a maximum capacity of 375 gal., distributed in six 62.5-gal. tanks. Four of the tanks are located in the center wing; two in the outer wing panels. The latter, normally used for fuel, can also be used for spray, in which case bladder-type fuel cells are installed outboard of the spray tanks.

Other Features

Other features of the system:

• **Flow rate indicator** calibrated in gallons per minute to enable the pilot to make easy in-flight adjustments, thereby assuring accurate and selective spray flow.

• **Flow rates** of the spray system range from ½ to 20 gal. per acre based on 80 mph. airspeed and 45-ft. swath width. The company reports swaths up to 125 ft. wide can be achieved.

• **Spray boom,** located between the flap, aileron and the aft spar of the wing, is well out of the slipstream and easily accessible for maintenance.

• **Non-corrosive lightweight nozzle** with interchangeable tips has been introduced into the system. Optimum patterns and spray distribution by correct nozzle spacing across the boom will be determined through flight tests. The company hopes to achieve an optimum range of 200-800 micron particle sizes at all flow rates up to 20 gal. per acre.

• **Easily operated dump valve** control is provided for jettisoning the liquids in a matter of seconds in case of emergency.

The company reports interest by domestic and foreign customers. George S. Wing, Transland president, under whose direction the airplane was designed, told AVIATION WEEK:

Foreign Customs

"We have had inquiries from potential customers all over the world. We believe the demand for the aircraft will be as heavy in the United States as all of the world combined. In the U. S. alone replacements for agricultural aircraft number about 250 a year."

Transland recently completed a new office-factory covering 33,000 sq. ft. on 14 acres adjacent to Torrance Municipal Airport.

It provides a substantial facility for airplane and spray/dust equipment production as well as engineering and test programs.

PRIVATE LINES

Natural color aerial photography is being used by Hycon Aerial Surveys, Inc., Pasadena, Calif., for geological mapping projects.

Yuma County Airport, Ariz., will be renamed Vincent AFB on Sept. 1, in honor of the late Brig. Gen. Clinton D.

Planeport Keeps Demonstrators Sheltered

Faced with the problem of moving their Cessna demonstrators out of their hangars to make room for executive tenants, Lane Aviation Corp., Columbus, Ohio, had Ideco Co., build this open-air shelter. It not only keeps the planes out of the weather, but makes them readily accessible for showing to prospects. Internal construction of the planeport is identical to Ideco's T-hangars.

Vincent, USAF, former deputy chief of staff, operations, Air Defense Command and Continental Air Defense Command. He played an important role in development of the ADC Weapons Development Center at Yuma.

Series of four sailplanes has been designed by William Briegleb featuring all-plywood kit construction, simplified for assembly by amateurs. Model BG-11 is a single-place utility glider; BG-12 a single-place high-performance type; BG-14 a two-place utility and BG-15 a two-place high-performance sailplane. They will be available in three-types of kits of varying degrees of finish. BG-12 kits run from $1,595 to $695. Briegleb is located at El Mirage Airport, Adelanto, Calif.

Increased private flyer facilities budgeted at Phoenix, Ariz., includes erection of 32 additional T-hangars to cost $84,000.

Cantilever hangar costing $326,325 will be built for fixed base operators at Denver, Colo., Municipal Airport by Erwin-Newman Co. The structure will provide approximately 20,000 sq. ft. for aircraft storage and a minimum of 6,000 sq. ft. for offices.

Aero Corp., Atlanta, Ga., delivered its first six helicopters to the Army following an Inspect and Repair as Needed (IRAN) contract, expects to be overhauling and delivering 25 helicopters and 18 liaison planes a month by mid-summer.

Dutchess County Airport Commission proposes that the city build a $175,000 hangar at the airport and lease it to International Business Machines under a 20-yr. contract to house the IBM corporate plane fleet. Proposal calls for IBM to pay five percent of construction costs annually plus yearly rental of $1,800.

A Hiller helicopter is used by Fastener Corp., Chicago, Ill., to pick up representatives at Chicago airports and fly them to its suburban Franklin Park factory.

Aero Commander franchise has been granted Minnesota Airmotive, Inc., Minneapolis, covering Minnesota, North and South Dakota and part of Iowa

A contract for a 10,000-mi. aerial magnetometer survey of the Ganges River basin in India will be handled by a DC-3 operated by Spartan Air Services, Ltd., Ottawa, Canada. The survey is expected to uncover large oil deposits whose presence has been indicated on preliminary tests.

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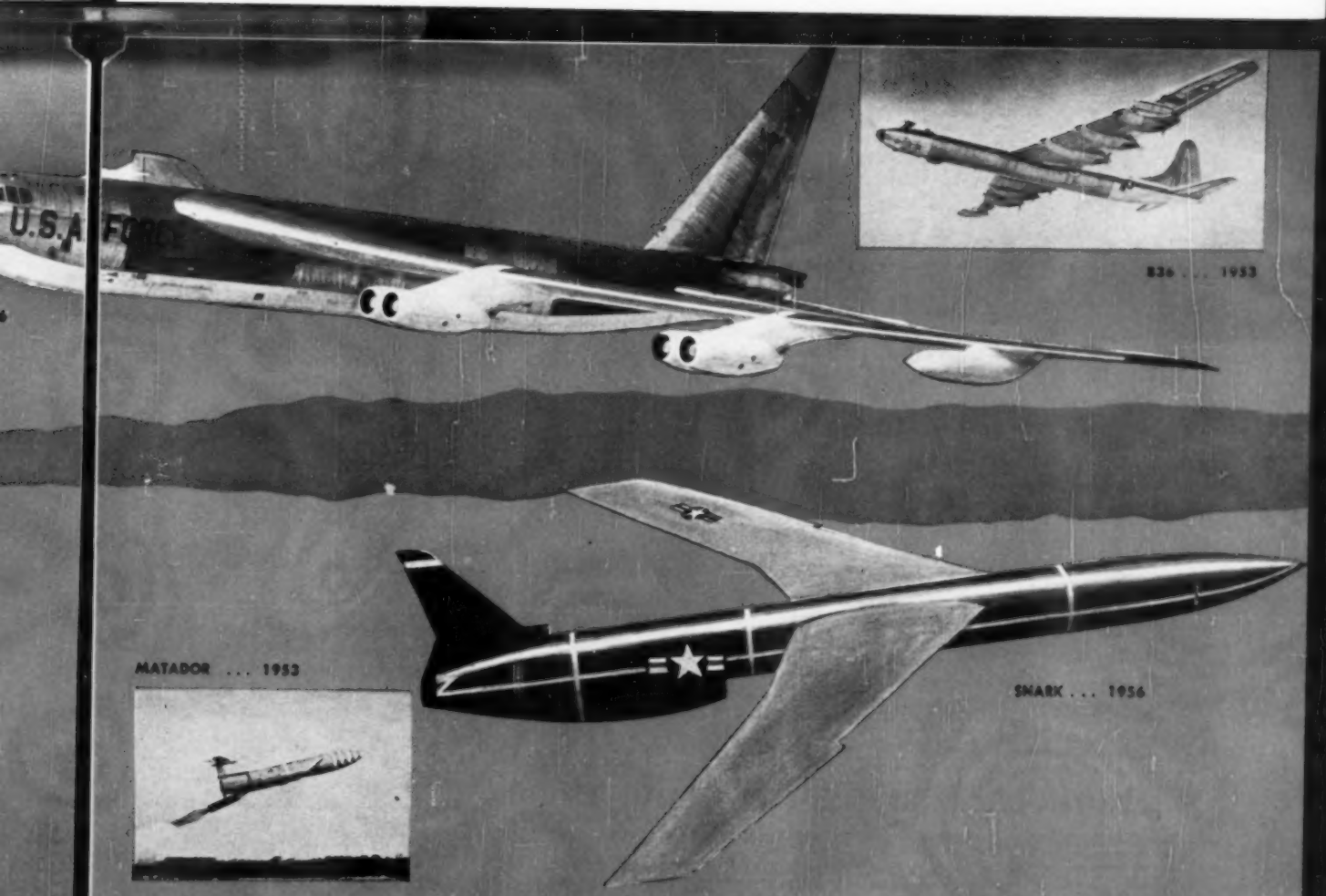

EXCERPT FROM HEADQUARTERS ARDC LETTER TO AVIATION WEEK

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AVIATION WEEK

A McGRAW-HILL PUBLICATION ABC ABP

INTEGRATED cowl, oil coolers, wheel doors reduce drag in DC-3 modification.

Engine Kit Adds 20 mph. to DC-3 Without Increasing Horsepower

Los Angeles—A modification package for the DC-3 by Garrett Corp.'s AiResearch Aviation Service Division provides 20 mph. greater speed without increasing horsepower.

AiResearch's "Maximizer" kit is designed for simplicity and easy installation. Cost is approximately $15,000.

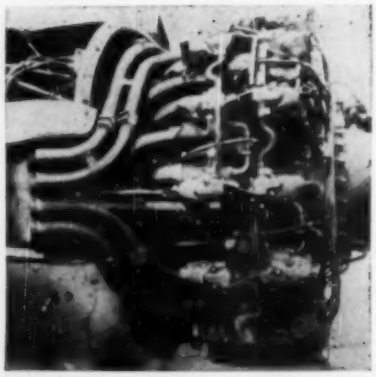
The kit is designed to reduce drag and incorporates an integrated system of engine cowling, engine baffles, oil cooler ducting, wheel-well doors and exhaust system.

Differences in true airspeeds between a standard DC-3 and one equipped with the Maximizer based on 600 brake horsepower, is a guaranteed 20 mph. on the basis of a gross weight of 25,000 lbs. at 10,000 ft. altitude with P&W R1830-92 engines. The speed factor will vary, of course, with lower or higher altitudes. For example at 5,000 ft. with true air speed of 179 mph., the Maximizer increases speed to about 197 mph.; at 15,000 ft. true air speed of 194 is increased to 218 mph.

The Maximized DC-3 flying at 10,000 ft. with a gross weight of 25,000 lbs. using 600 hp. from each engine will also gain 200-mi. extra flight range or one-hour flight time, without additional fuel or larger engines.

The new cowl increases engine cooling efficiency by improving the pressure distribution of incoming air across the front face of the engine. New contour creates smoother airflow over the nacelles. Engines have tailored flow-control baffles. Greater pressure recovery and improved oil cooling is given by the diffuser-entrance design. In addition to substantial reduction of the drag burden with streamlined wheel well doors, a fairing on the tail wheel further improves the drag reduction factor.

Ben O. Howard, well-known racing pilot and aircraft designer, headed the team that produced the Maximizer. Equipment and shop skills needed for installation do not exceed those normally found in a facility servicing DC-3 type equipment, according to AiResearch. Man-hours required for installation, excluding baffles, total approximately 200 hrs. Distribution of the various items allow a number of men to work simultaneously.



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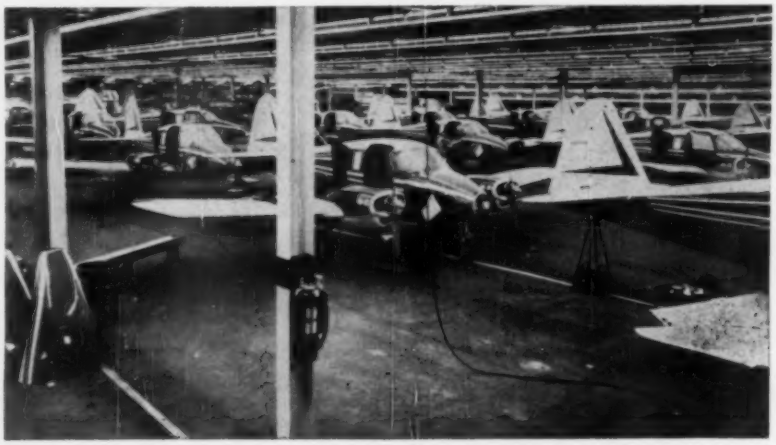

Piper Turns Out Two Apaches Daily

Completion of a 60,000-sq.-ft. assembly building at Lock Haven, Pa., enabled Piper Aircraft Corp. to step up production of its light twin-engine Apache business planes to two a day. Picture shows typical final assembly scene with planes crowding the lines. Soon to get underway is 400-ft. extension of Piper's main assembly building to handle production of its all-metal single-engine Comanche, which started flight tests recently (AW June 11, p. 109). Initial Comanche production begins by the end of 1956.

ratios for **gear-head servo motors,** Norden-Ketay Corp., 99 Park Ave., New York, N. Y. . . . Illustrated case history of **power belt conveyor system** taking baggage from behind terminal ticket counter to loading area, Field Report 96, Rapids-Standard Company, Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich.

Catalog of 56 **subminiature switches, auxiliary actuators and switch assemblies,** Micro Switch, Freeport, Ill. . . . Description, specifications, operation and performance data of USAF Type MA-1A **mobile air compressor (ground support),** special engineering release, AiResearch Manufacturing Division of Arizona, Sky Harbor Airport, Phoenix, Ariz. . . . Technical information on **Model AT1A, Type 20A220 flowmeter,** catalog sheet RC-1, Rotron Controls Corp., Woodstock, N. Y.

Laboratory facilities, technical data and SAE specifications of **metallic abrasives,** Catalog No. 556, Cleveland Metal Abrasive Co., 800 East 67th St., Cleveland, Ohio. . . . Handling Materials Illustrated, covering applications and use of **fork lift trucks,** Towmotor Corp., 1226 East 152nd St., Cleveland 10, Ohio. . . . Design and application data for **belt conveyors to handle bulk materials,** Limberoller Belt Idler Booklet 2-59, Joy Manufacturing Co., 307 Oliver Bldg., Pittsburgh 22, Pa.

Illustrations, specifications and dimensions of **single-, double- and triple-action underdrive presses,** catalog, Danly Machine Specialties, Inc., 2100 So. Laramie Ave., Chicago 50, Ill. . . . Information and drawings of **manually reset vibration monitors and malfunction detectors,** Bulletin 500-1A, Beta Corp., P. O. Box 8625, Richmond 26, Va. . . . Description and applications of Ampco-Trode **electrodes,** Bulletin W-25a, Ampco Metal, Inc., 1745 So. 38 St., Milwaukee, Wis.

Publications Received

• *The Exploration of Mars*—by Willy Ley and Wernher Von Braun—Paintings by Chesley Bonestell—Pub. by The Viking Press, Inc., 18 East 48th St., New York 17, N. Y. $4.95; 176 pp.

A comprehensive account of existing knowledge of Mars, and past and present theories. The authors have outlined a master blueprint for man's first exploring trip to this planet. (Publication date: June 22, 1956)

• *Manual of Excellent Managements*—Pub. by the American Institute of Management, Inc., a Non-Profit Foundation. $20.00; 192 pp.

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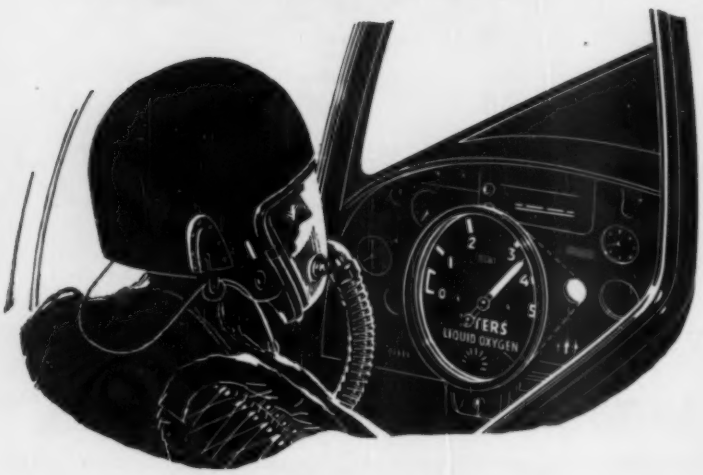

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tices are worthy of a rating of excellent are listed and discussed in this publication.

• *The Growing Shortage of Scientists and Engineers*—Pub. by New York University Press, Washington Square, New York 3, N. Y. $4.00.

Record of the proceedings of a conference held in November, 1955, under the auspices of the Edison Foundation, to discuss United States deficiency in the training of technical experts.

• *Molecular Flow of Gases*—by G. N. Patterson—Pub. by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. $7.50; 217 pp.

A new approach to fluid mechanics. Individual chapters include: the fundamental equations, isentropic flow, basic equations for nonisentropic flow, nonisentropic flows, and mechanics of rarified gases. The appendix covers mathematical aids, differential equations and their characteristics, and a summary of the derivation of the basic equations of motion of a gas according to molecular theory—Burnett equations.

• *Recommendations on Cockpit-Visibility Standards for Transport-Type Aircraft*—Put out by CAA Technical Development and Evaluation Center—$.50; 6 pp. (Order PB 121011 from OTS, U. S. Department of Commerce, Washington 25.)

Discusses recommended minimum standards for cockpit visual angles.

• *Aircraft Fire Extinguishment (Part V)*—Put out by CAA Technical Development and Evaluation Center—$.50; 10 pp. (Order PB 121010 from OTS, U. S. Department of Commerce, Washington 25.)

A preliminary report on high-rate-discharge fire-extinguishing systems for aircraft power plants.

• *Ground Calibration of the VOR*—Put out by CAA Technical Development and Evaluation Center—$.75; 18 pp. (Order PB 121012 from OTS, U. S. Department of Commerce, Washington 25.)

This report describes a simple and accurate method of calibrating VOR stations with a portable detector mounted on the edge of the counterpoise.

• *Aircraft Production Methods*—by Gordon B. Ashmead—Pub. by Chilton Publications, Chestnut and 56th Streets, Philadelphia 39, Pa. $7.50; 293 pp. and over 300 official photographs.

Development of airplane designs and carrying the design into production.

THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

A Threat to Economic Progress

THERE are two paramount reasons for concern over the serious shortage of scientists and engineers that now confronts the United States:

- The first reason, with which this editorial deals, is that continued expansion of our economy and further increases in our living standards are threatened unless we train more scientists and engineers and use them more effectively.
- The second reason for concern is that we run the risk of falling behind the Soviet Union in the technology so essential to national security. The consequences of losing this race to the Russians are not comforting. (The possibility that this might happen over the next few years was discussed in an earlier editorial in this series.)

The crucial contribution of scientists and engineers to the well-being of the American people has been to find ways of making better use of limited resources, to make equipment more productive, to develop new and better products that enrich our lives, to enable us to live longer and be healthier. They have made this contribution with greater success in the last 15 years than ever before, but it has required progressively more resources and more trained people.

During this 15-year period our annual production of goods and services, in dollars of constant purchasing power, has almost doubled. Since our total population has increased only 25 percent, this has meant a tremendous rise in the economic well-being of the American people as a whole. But in accomplishing this, the number of scientists and engineers has been more than doubled.

Tasks for Research

If the American economy is to continue to grow and if our living standards are to show further improvement, the work of scientists and engineers must be stepped up even more in the years ahead. Unless answers to several pressing problems are found through intensified research efforts, economic progress will become increasingly more difficult.

Productivity per hour of labor must be increased at a faster rate. Improved medical care has greatly increased the number of people who attain retirement age, and sharply higher birth rates since the war will mean larger numbers of children in school and college. Meantime, because of low birth rates during the depression, the number of people reaching working age is not rising nearly so fast. The result is that over the next 20 years our population will increase by about one-third, while the total manhours worked are not expected to increase more than 15 percent. So, simply to maintain the same living standards for a rising population — with no provision for additional improvements — ways must be found to enable each worker to produce for more dependents.

It is primarily to the scientists and engineers that we must look for help in making human labor more productive. This will require enormous increases in our power

resources. We will need to make more effective use of our existing fuel supplies — coal, oil and natural gas. And we will have to devise economically practical means of tapping other energy sources, particularly nuclear power and new rocket fuels.

Also, better ways must be found to use scarce and low-grade raw materials. Thanks to great strides in metallurgy and mining techniques, we are now utilizing sources of copper and iron ore that, for all practical purposes, were not available to us only ten years ago. Similar strides are needed in the mining and processing of bauxite if low-grade domestic ores are to help satisfy a fast-growing market for aluminum. And stubborn technical obstacles in the area of "high temperature" metals—such as nickel, cobalt, columbium, tantalum and titanium — are impeding progress in jet and turbine engines.

These are only a few of the challenging tasks that demand intensified research and engineering activity in the years immediately ahead if the United States is to continue to raise living standards. We need more houses, schools and highways for a rising population, more medical research to reduce further the ravages of illness, more research in chemistry and other sciences to sustain the flow of new and improved products that are so essential an ingredient of our economic progress.

Ceiling on Growth

American industry has indicated that it is ready to meet the challenge and undertake vastly expanded research programs. A recent survey conducted by the McGraw-Hill Department of Economics revealed that total research and development expenditures of American industry were almost $5 billion last year, 29% higher than in 1953. By 1959 business plans to be spending well over $6 billion on research and development. And the total could well prove to be much higher, based on the trend of recent years.

But industry's programs for research and development cannot be carried out unless enough qualified research workers and engineers are available. Ernest R. Breech, chairman of the Ford Motor Company, recently described the supply of engineers as the "ceiling on our future growth." He gave force to his point by announcing: "If 900 qualified engineers were to approach us next week looking for jobs, we would hire every one." The U. S. Bureau of Labor Statistics found in interviews with some 200 large companies at the end of 1954 — a recession year — that at least half were unable to hire enough research scientists and engineers to meet their needs. A third of the companies reported substantial shortages of technical personnel.

The shortage of technically trained people, furthermore, is becoming more acute. The number of engineers and scientists now being graduated is only about enough to cover replacement requirements, while the needs of industry, government and education are mounting every year. According to the best information available — as indicated in the first editorial in this series — these needs are now about twice as great as our current engineering graduating classes and annual production of scientists with Ph. D. degrees.

To perform the research needed to remove roadblocks to our economic progress — and at the same time hold our own in the technology essential to our security as a free nation — we must have an adequate supply of men and women with engineering and scientific training. Instead, we are faced with an acute shortage, now and for several years to come. Reasons for the shortage and proposals for working our way out of the shortage will be discussed in the remaining two editorials in this series.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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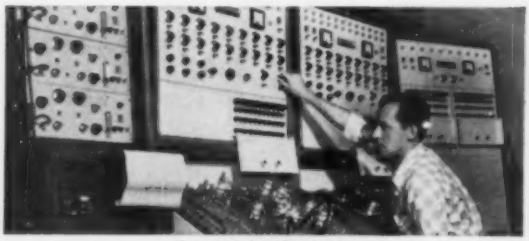

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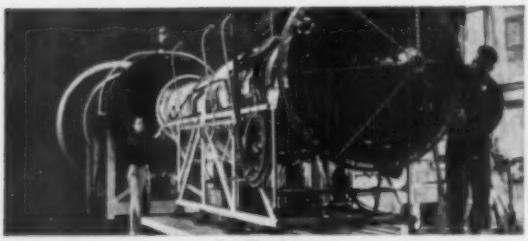

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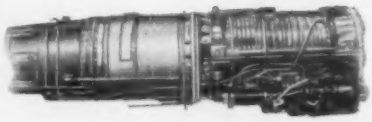

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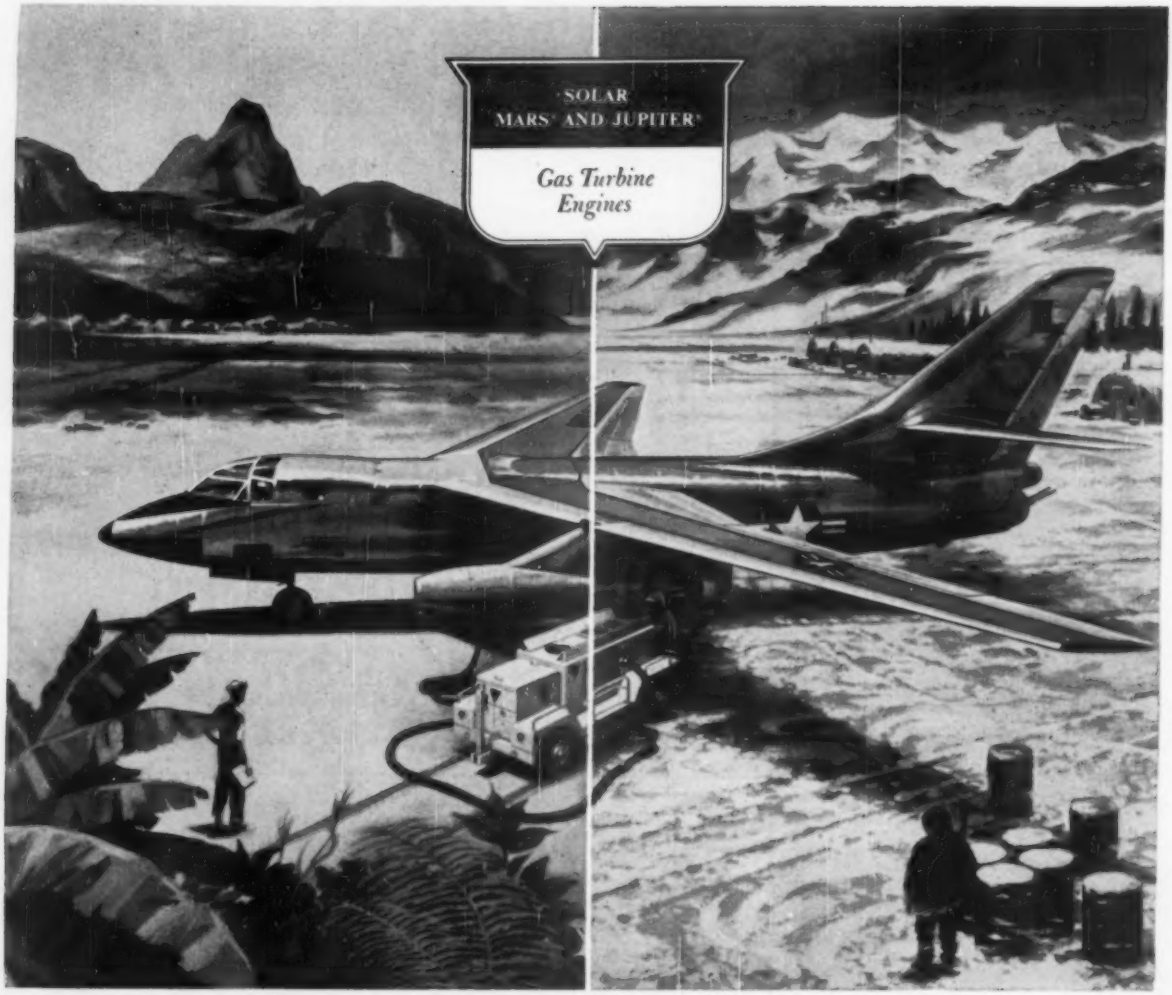

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LETTERS

Praise From Adams

One thousand congratulations on your editorial of June 11, "North Atlantic Fare Battle." I am personally delighted that a person of your position and responsibility in the industry has so clearly accentuated the affirmative in the matter of low fare air coach and its relationship to mass air transportation.

JOSEPH P. ADAMS
Vice Chairman
Civil Aeronautics Board

How Fang Changed

As one who worked many years with Jack Northrop at Northrop Aircraft Co., I have been reading with more than passing interest your series of articles on that company.

After reading your article last night on the Northrop Fang (AW June 4, p. 38) I thought it might be interesting to fill you in on some more of the background of this design.

The idea of the Fang was conceived by Jack Northrop as the next logical step to his successful post-war XS-4 transonic research aircraft. The Fang design was completed at the time of his retirement in November, 1952. The aircraft was exceptionally clean and at that time weighed 12,600 lb.

Shortly after Jack's retirement, in January, 1953, the design was resubmitted to the Air Force. By this time the new engineering management had altered the Northrop configuration by incorporating such changes as removing the engine from the fuselage in favor of a belly installation and incorporation of a V-tail (like the Bonanza). These changes, of course, increased the weight and reduced the performance. Air Force's interest in the Fang project began to dwindle.

In view of the above you probably have a misprint in your "Fang design started in May, 1953." You probably meant May, 1945 when the Air Force, during the post-war years, was seeking the answer for a supersonic light weight fighter and at that time contracted for the Northrop XS-4.

C. W. HARRIS
2624 N. Myers Street
Burbank, California

Driving Takes Time

The timely article dealing with unrealistic published schedules of the airlines which appeared in the Cockpit Viewpoint column (AW May 14, p. 51) was apparently overlooked by the enthusiastic advertising department of at least one major airline. At the time I thought your Captain Robson got in some good needling where some needling was due.

It's too bad some folks missed it because the race to sell speed has seemed to me to reach the ridiculous.

For example, may I call attention to a major airline's ad appearing in a leading Washington newspaper. It leads off with a bold eye catcher, "125 minutes from Pennsylvania Avenue to Peachtree Street." This refers to the leading streets of Washington and Atlanta.

Though I have done a little flying, I have not had occasion to ride in this particular airline's latest equipment and the ad caused me to stop and think. I reasoned that if the trip from downtown Washington to downtown Atlanta can be made in 2 hr. 5 min., including cab times, this airline really had something. So I started checking. One referred phone call to another finally put me in contact with the company's advertising department.

At this point it was patiently explained that the ad was merely dealing in SYMBOLS and that PENNSYLVANIA AVENUE was the SYMBOL for WASHINGTON and that PEACHTREE STREET was the SYMBOL for ATLANTA, and that most people knew that airline schedules were figured from airport to airport, and that I was reading something into the ad that didn't exist and that wasn't intended.

This has left me a little on the dizzy side and I can only scream, "Quick, Captain Robson, the Needle."

Let's have another article about realistic airline advertising and schedules for public consumption.

ROBERT E. TRIMBLE
1708 W Street, S. E.
Washington, D. C.

Why Not Army Air?

In answer to the Artillery Captain "Why Not Army Air" (AW May 28, p. 130). I am an Air Force Captain in the Reserves (Troop Carrier) and was a B-24 pilot in World War II. So much for my limited qualifications.

The Captain asks: (1) Why a "USAF bus for Army GI?" To me, the answer seems simple. The modern plane is a complex piece of machinery that must be operated and maintained by skilled and highly trained men. The Air Force has the men and program to produce this as a continuing measure. This I'm sure would be an added expense to the tax payer to have the Army set up a similar program. (2) The decision was made long ago by men with the power and vision to foresee these problems. The Army rules the ground, the Air Force—the air, the Navy—the sea. I don't know what the reasons are, but you can be sure they are not snap decisions. (3) If the Air Force were allowed to give the operation of assault and cargo aircraft to the Army, I must agree it would eliminate the fretting of USAF personnel about the c. g. and/or weight data and just put the worry in another place—the Army. Don't worry, Captain, the Air Force can and will remedy this in the normal course of operations. (4) There must be some misunderstanding. The C-123 will land almost on any fairly level ground. The maker will attest to that.

In conclusion, if and when the Captain is chief of staff he can change all this chaos, but until then, Captain, remember one of the lessons I was taught in cadet school—you should have learned this in OSC (maybe you did but forgot)—"Do not question the orders of your superior—do what they request first—then if found incorrect—notify through channels."

USAF CAPTAIN

Bitter Engineer II

In reply to the "Bitter Engineer" (AW June 4, p. 122) I want to say our employment situations are practically identical.

You must remember that in the aircraft industry your personal interests are of no concern. The aircraft industry is only concerned in accomplishing its own needs and the engineer's ability never enters the picture.

As long as the U. S. government continues to throw money around in a ridiculous fashion there will be a shortage of engineers. Engineers will be the instrument to be used as seen fit by the industry. Let the government of the U. S. curtail this fabulous spending and you will see the engineer shortage disappear. At this point you will see a great mass of unemployed engineers. You are wanted when there are contracts. You are of little concern when there are no contracts.

A coordinated missile program would produce far superior missiles and at less cost, but a couple of things must be remembered:

(1) This will not set well with the aircraft industry for the government would not be throwing money in its direction as ridiculously as now.
(2) This would result in a condition of mass unemployment and blow up prosperity in the Republicans' face.

(I am neither a Republican or Democrat and have no political interests.)

Who will employ these men now obtaining employment or who have received employment because of the U. S. government's ridiculous spending?

Will the aircraft industry keep in its employ the men they have hired when the U. S. government stops spending?

How secure is the young engineer's future with the aircraft industry? (This obviously does not apply to young engineers or engineers to be whose fathers are well established in the industry as president, on the board of directors, etc.)

The American people live in a dream world with their heads in the clouds. They have been told by the politicians that peace and prosperity exist, and this is all that is necessary. They fail to see the peril that really exists and it is not war. Throughout history many nations have risen to a great world power only to fall due to their ignorance.

NAME WITHHELD

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

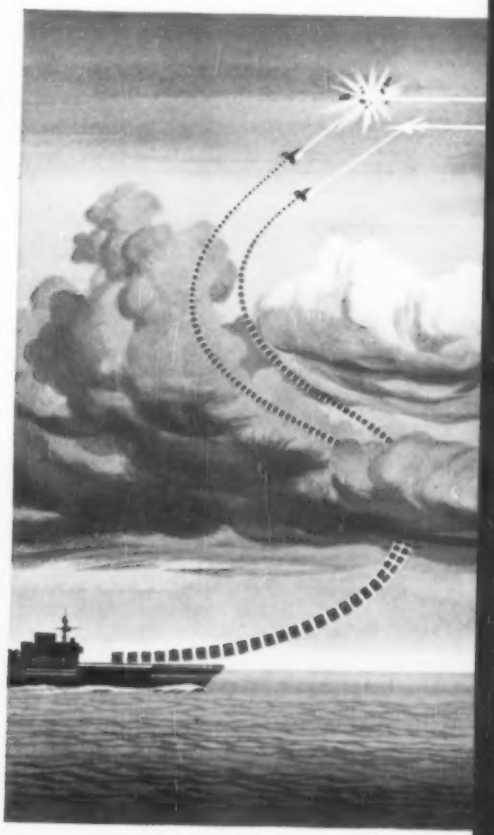
WITHIN SECONDS after locating an invading jet, this Navy fighter pilot in his Chance Vought F7U Cutlass can shoot it out of the air. Good marksmanship plus a good missile—the Navy's Sparrow I.

LIGHT AND COMPACT, Sparrow I is carried under the interceptor's wings—can be launched singly or in rapid succession. Warhead is powerful enough to destroy largest known bomber.

AIR-TO-AIR MISSILE JOINS FLEET

Sparrow I assigned to Carrier Operations

IN ACTION, Navy pilot locates and tracks target with radar in cockpit. With plane aimed at target, pilot launches rocket-powered Sparrow I which rides a radar beam at more than 1500 miles an hour to intercept the target, even under evasive action. Against planes and other missiles, Sparrow I has proved its effectiveness.



SPARROW I weapon system, developed and produced by Sperry for the Navy's Bureau of Aeronautics, is an important combat-ready weapon in the nation's arsenal for defense. In addition to Sparrow I, Sperry is currently engaged in several other missile projects involving all types of these new weapons so vital to deterring aggression.

SPERRY GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION

E B POWER GS
UNIVERSITY MICROFILM IN
313 N 1ST ST
ANN ARBOR MICH

23 billion-mile fastener field test

How many fasteners can you name that have been "family" tested for four generations? Behind this rare group portrait of the illustrious Douglas DC's lie literally billions of miles of severe usage in every climate and condition on the face of the earth. And tens of millions of Elastic Stop® nuts have gone every inch of the way, performing critical fastening jobs on engines and air frames. In fact, for over three decades of Douglas air frame development, Elastic Stop nuts, with their familiar red collars, have been specified for critical structural fastenings.

If you recognize the practical value of "flight-tested" experience on all types of air frames and engines . . . you'll rely on Elastic Stop nuts.

ELASTIC STOP NUT CORPORATION OF AMERICA

Dept. N95-725 · 2330 Vauxhall Road · Union, N. J.

Red *Nylon* INSERTS are standard on all ESNA fixed fasteners guaranteeing:

- extended reusability
- vibration-proof locking
- thread sealing . . . no galling
- immediate identification
- adaptability to all shapes and sizes of aircraft fittings
- suitability to production line assembly methods